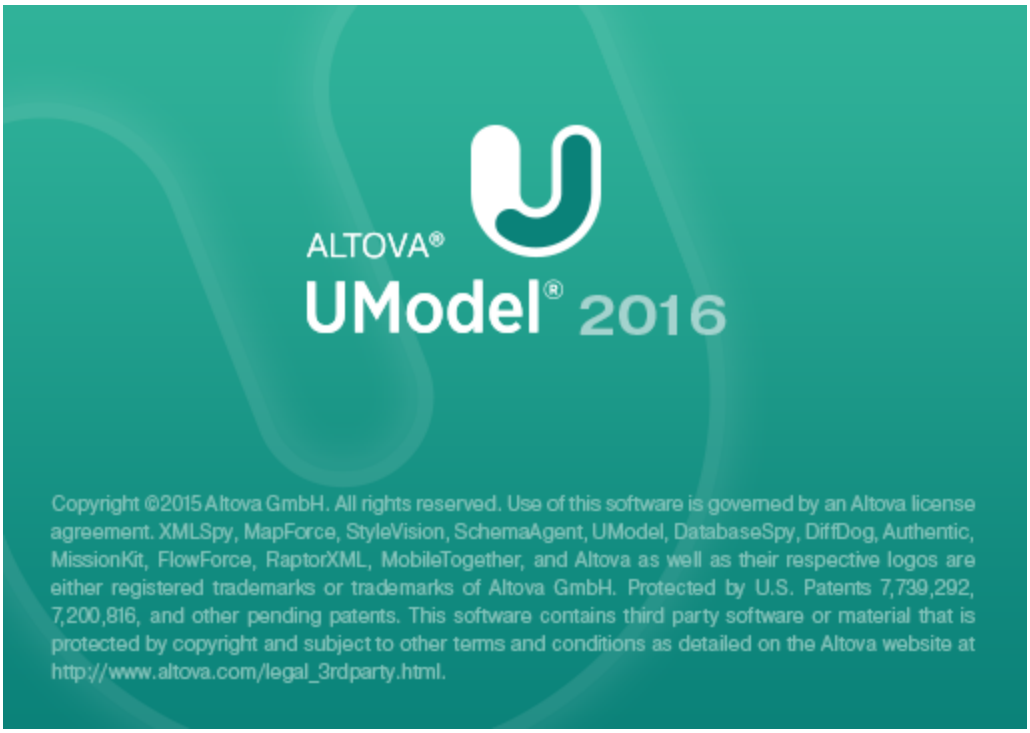
User and Reference Manual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Altova UModel 2016 User & Reference Manual

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Chapter 1

UModel

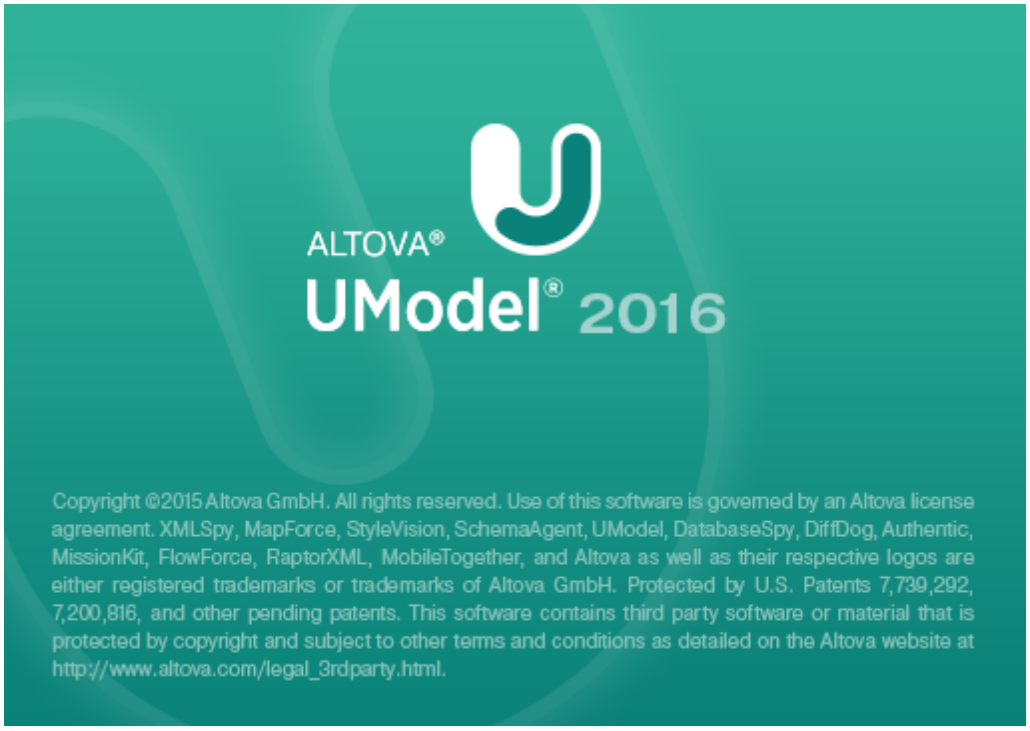
1 UModel

UModel® 2016 Basic Edition is an affordable UML modeling application with a rich visual interface and superior usability features to help level the UML learning curve, and includes many high-end functions to empower users with the most practical aspects of the UML 2.4 specification. UModel is a 32/64-bit Windows application that runs on Windows Server 2003/2008/2012, Windows XP, Windows Vista, Windows 7, Windows 8, and Windows 10. 64-bit support is available for the Enterprise and Professional editions.

UModel® 2016 supports:

- All 14 UML 2.4 modeling diagrams
- Support for the Model Driven Architecture (MDA) which allows conversion between different programming languages (Enterprise edition only)
- Ability to import and export SQL databases into UModel (Enterprise/Professional editions only)
- Teamwork support - allowing concurrent project editing
- 3-way project merging
- Protocol State Machines
- SysML 1.2 diagrams (Enterprise/Professional Edition only)
- Sequence Diagram generation directly from source code
- Code generation from State Machine diagrams
- UModel API and plugin (Enterprise/Professional Edition only)
- Built-in Scripting environment and Form editor (Enterprise/Professional Edition only)
- Visual Studio integration (Enterprise/Professional Edition only)
- Eclipse integration (Enterprise/Professional Edition only)
- Support for version control systems
- XML Schema diagrams
- Business Process Modeling Notation 1.0 and 2.0 (Enterprise/Professional Edition only)
- Multiple layers per UML diagram (Enterprise/Professional Edition only)
- Import of Java, C# and Visual Basic binaries
- Hyperlinking of diagrams and modeling elements
- Syntax coloring in diagrams
- Cascading styles
- Unlimited Undo and Redo
- Java, C# and Visual Basic code generation from models
- Reverse engineering of existing Java, C#, and Visual Basic source code
- Complete round-trip processing allowing code and model merging
- XMI version 2.4 for UML 2.0, 2.1, & 2.1.2, 2.2, 2.3, 2.4 - model import and export
- Generation of UModel project documentation

These capabilities allow developers, including those new to software modeling, to quickly leverage UML to enhance productivity and maximize their results.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Last updated: 24 September 2015

Chapter 2

Introducing UModel

2 Introducing UModel

Altova web site: Introduction to Altova UModel

The UML is a complete modeling language but does not discuss, or prescribe, the methodology for the development, code generation and round-trip engineering processes. UModel has therefore been designed to allow complete flexibility during the modeling process:

- UModel diagrams can be created in any order, and at any time; there is no need to follow a prescribed sequence during modeling.
- Code, or model merging can be achieved at the project, package, or even class level. UModel does not require that pseudo-code, or comments in the generated code be present, in order to accomplish round-trip engineering.
- Code generation in UModel is based on Spy Programming Language (SPL) templates and is completely customizable. Customizations are automatically recognized during code generation.
- Code generation and reverse-engineering currently supports the following languages:

Language	Version
C#	1.2, 2.0, 3.0, 4.0, 5.0
Java	1.4, 5.0 (1.5), 6, 7, 8
Visual Basic .NET	7.1, 8.0, 9.0

- A single project can support Java, C#, or VB.NET code simultaneously.
- Support for UML templates and generics.
- XML Metadata Interchange (XMI 2.1 for UML 2.0, 2.1.2, 2.2, 2.3, and XMI 2.4 for UML 2.4.1)
- When adding properties or operations, UModel provides in-place entry helpers to choose types, protection levels, and other properties that are also available in industrial-strength IDEs such as XMLSpy, Visual Studio or Eclipse.
- Syntax-coloring in diagrams makes UML diagrams more attractive and intuitive.
- Modeling elements and their properties (font, colors, borders etc.) are completely customizable in an hierarchical fashion at the project, node/line, element family and element level.
- Customizable actors can be defined in use-case diagrams to depict terminals, or any other symbols.
- Modeling elements can be searched for by name in the Diagram tab, Model Tree pane, Messages and Documentation windows.
- Class, or object associations, dependencies, generalizations etc. can be found/ highlighted in model diagrams through the context menu.
- The unlimited levels of Undo/Redo track not only content changes, but also all style changes made to any model element.

Please note:

This document does not attempt to describe, or explain, the Unified Modeling Language (UML); it describes how to use the UModel modeling application, to model code and achieve round-trip engineering results.

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Chapter 3

UModel tutorial

3 UModel tutorial

This tutorial describes, and follows, the general sequence used when creating a modeling project in UModel.

The major portion of the tutorial deals with the forward-engineering process, i.e. using UModel to create UML diagrams and generate code as the precursor to the round-trip engineering sections that follow. The round-trip engineering sections describe the process from both code and model vantage points.

The tutorial describes the following UML diagrams, and how to manipulate the various modeling elements within them. The following diagrams and follow-on tasks are discussed:

Forward engineering process:

- Use cases
- Class diagrams
- Object diagrams
- Component diagrams
- Deployment diagrams

Round-trip process (model - code - model)

- Code generation from UModel
- Add a new operation to the external code
- Merge the external code back into UModel.

Round-trip process (code - model - code)

- Import code produced by XMLSpy from a directory (or from a project file)
- Add a new class to the generated model in UModel
- Merge the updated project with the external code.

All the files used in this tutorial are initally available in the **C:\Documents and Settings\All Users \Application Data\Altova** folder. When any single user starts the application for the first time, the **example** files for that user are copied to **C:\Documents and Settings\<username>\My Documents\Altova\UModel2016\UModelExamples** folder. Therefore do not move, edit, or delete the example files in the initial ...\All Users\.... directory.

BankView-start.ump
is the UModel project file that constitutes the initial state of the tutorial sample. Several model diagrams as well as classes, objects, and other model elements exist at this stage. Working through the tutorial adds new packages, model diagrams and many other elements that will acquaint you with the ease with which you can model applications using UModel. Please note that the syntax check function reports errors and warnings on this file, the tutorial shows you how to resolve these issues.

BankView-finish.ump
is the UModel project file that constitutes final state of the tutorial sample, if you have worked through it step by step. This project file is the one used when generating code and synchronizing it with UModel.

- The **OrgChart.zip** file supplied in the folder is used for the round-trip engineering process. Please unzip it in the ...**UModelExamples** folder before starting the section.

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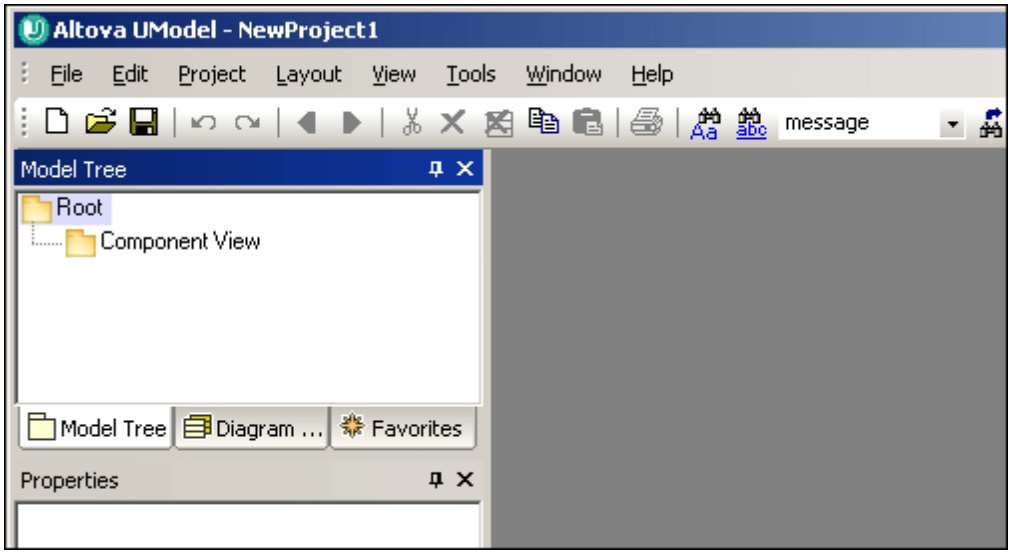
Additional example files for both **Java** and **C#** programming languages are also available in the same directory, i.e. **Bank_Java**.ump, **Bank_CSharp**.ump and **Bank_MultiLanguage**.ump. These project files also contain Sequence diagrams which are described later in this documentation.

A section describing how to start a project from scratch and generate code, is included in the Projects and code engineering section.

3.1 Starting UModel

Having installed UModel on your computer:

1. Start UModel by double-clicking the UModel icon on your desktop, or use the **Start | All Programs** menu to access the UModel program.
   UModel is started with a default project "NewProject1" visible in the interface.



   Note the major parts of the user interface: the three panes on the left hand side and the empty diagram pane at right.

   Two default packages are visible in the Model Tree tab, "Root" and "Component View". These two packages cannot be deleted or renamed in a project.

To open the BankView-start project:

1. Select the menu option **File | Open** and navigate to the ...**UModelExamples\Tutorial** folder of UModel. Note that you can also open a *.ump file through a URL, please see Switch to URL for more information.
2. Open the **BankView-start.ump** project file.
   The project file is now loaded into UModel. Several predefined packages are now visible under the Root package. Note that the main window is empty at the moment.

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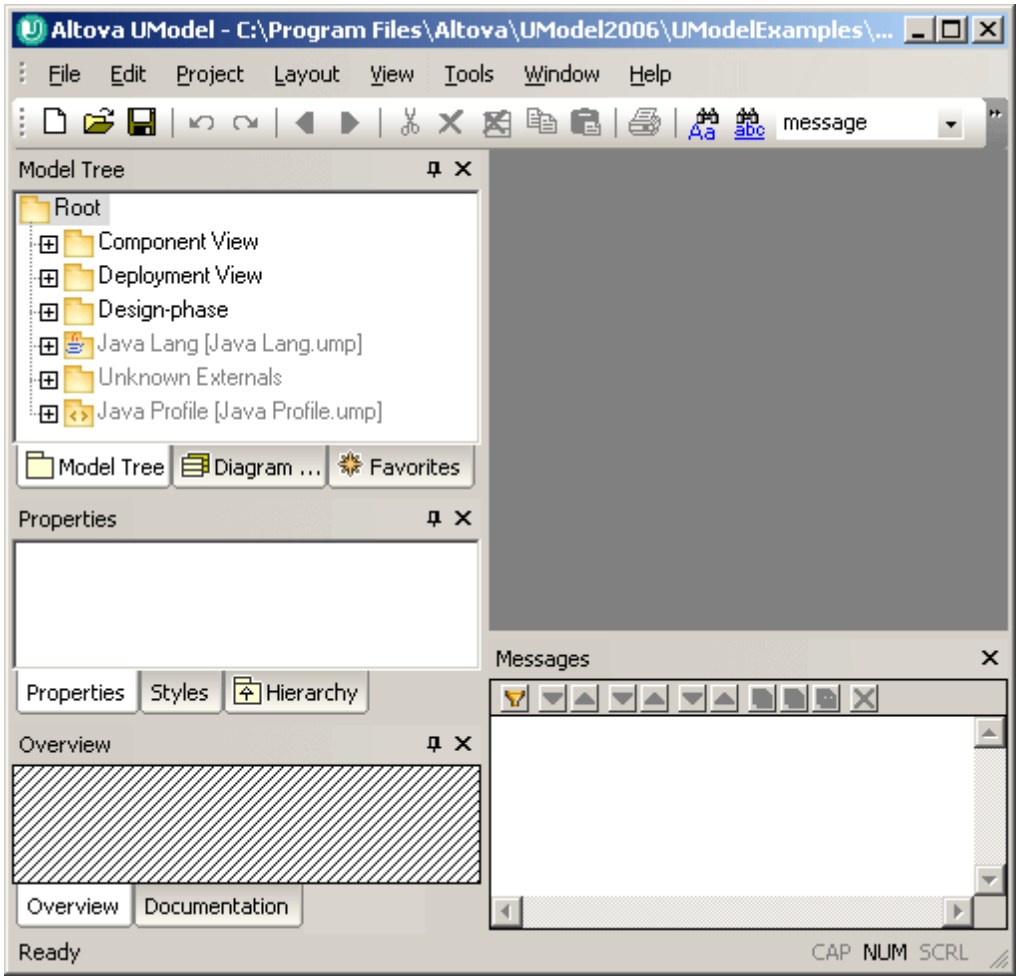

The Model Tree pane displays various views of your modeling project:

- The **Model Tree** tab contains and displays all modeling elements of your UModel project. Elements can be directly manipulated in this tab using the standard editing keys as well as drag and drop.
- The **Diagram Tree** tab allows you quick access to the modeling diagrams of you project wherever they may be in the project structure. Diagrams are grouped according to their diagram type.
- The **Favorites** tab is a user-definable repository of modeling elements. Any type of modeling element can be placed in this tab using the "Add to Favorites" command of the context menu.

The Properties pane displays two views of specific model properties:

- The **Properties** tab displays the properties of the currently selected element in the Model Tree pane or in the Diagram tab. Element properties can defined or updated in this tab.
- The **Styles** tab displays attributes of diagrams, or elements that are displayed in the Diagram view. These style attributes fall into two general groups: Formatting and display settings.
- The **Hierarchy** tab displays all relations of the currently selected modeling item, in two different views. The modeling element can be selected in a modeling diagram, the Model

Tree, or in the Favorites tab.

The Overview pane displays various tabs:

- The **Overview** tab which displays an outline view of the currently active diagram.
- The **Documentation** tab which allows you to document your classes on a per-class basis.

Modeling element icon representation in the Model Tree

Package types:

UML Package
Java namespace root package
C# namespace root package
Visual Basic root package
XML Schema root package
Java, C#, VB code package (package declarations are created when code is generated)

Diagram types:

Activity diagram
Class diagram
Communication diagram
Component diagram
Composite Structure diagram
Deployment diagram
Interaction Overview diagram
Object diagram
Package diagram
Profile diagram
Sequence diagram
State Machine diagram
Timing diagram
Use Case diagram
XML Schema diagram
Business Process Modeling Notation

Element types:

An element that is currently visible in the active diagram is displayed with a blue dot at its base. In this case a class element.

Class Instance/Object
Class instance slot

Class
Property
Operation
Parameter

Actor (visible in active use case diagram)
Use Case
Component
Node
Artifact
Interface

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Relations (/package)
Constraints

3.2 Use cases

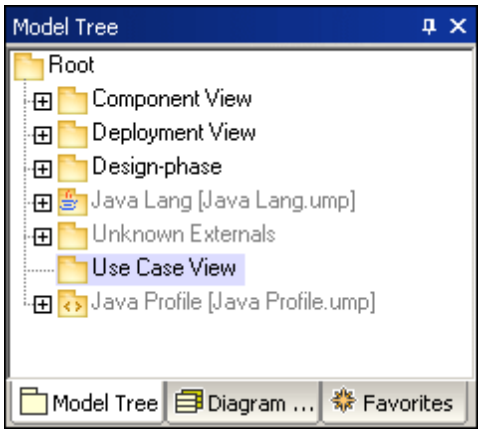
Altova web site: UML Use Case diagrams

The aim of this tutorial section is to:

- Add a new **package** to the project
- Add a new Use Case **diagram** to the project
- Add use case **elements** to the diagram, and define the dependencies amongst them
- Align and size elements in the diagram tab.

To add a new package to a project:

1. Right click the **Root** package in the Model Tree tab, and select **New Element | Package**.
2. Enter the name of the new package e.g. **Use Case View**, and press Enter.



Please see Packages for more information on packages and their properties.

Adding a diagram to a package:

1. Right click the previously created Use Case View package.
2. Select **New Diagram | UseCase Diagram**.

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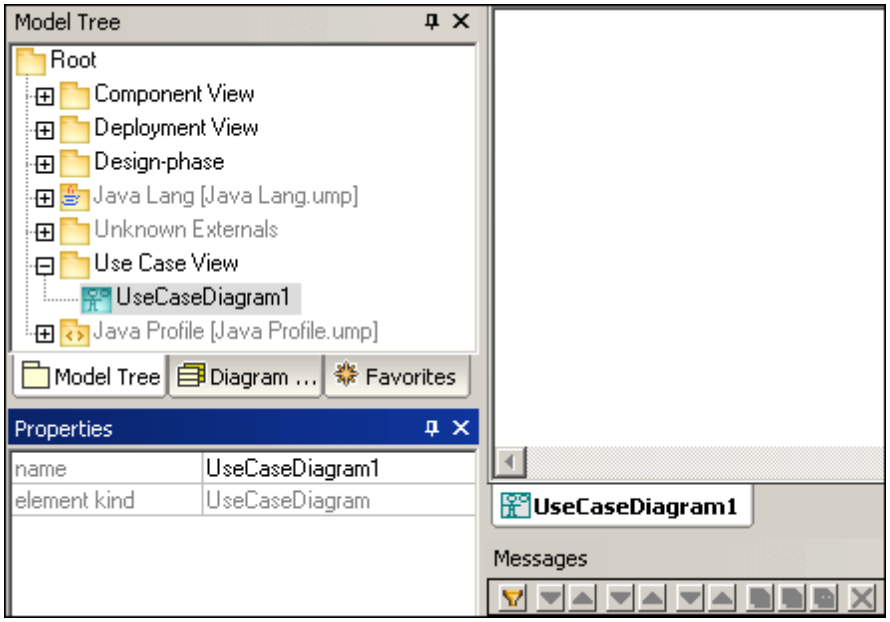
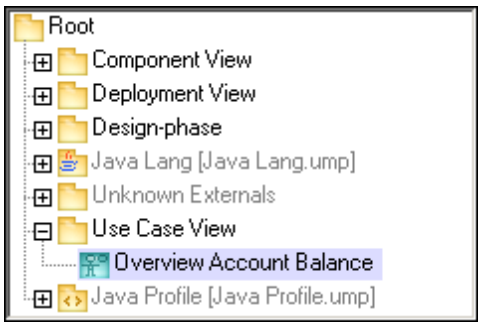


A Use Case diagram has now been added to the package in the Model Tree view, and a diagram tab has been created in the diagram pane. A default name has been provided automatically.

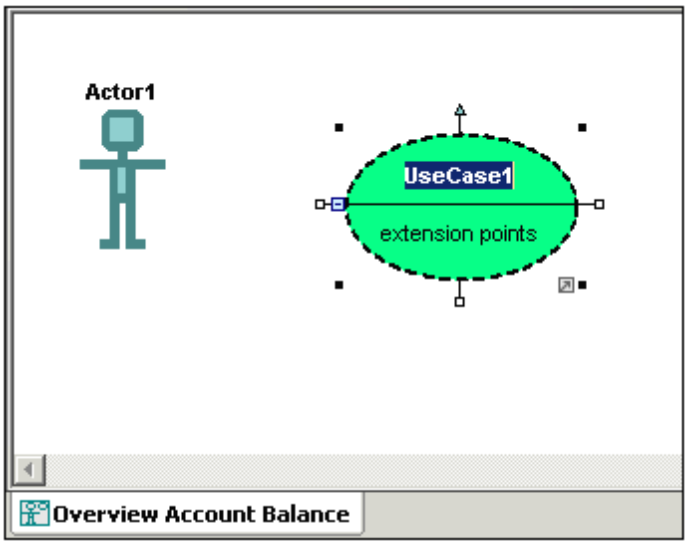
3. Double click the supplied name, in the Model Tree tab, change it to "Overview Account Balance", and press Enter to confirm.



Please see Diagrams for more information on diagrams and their properties.

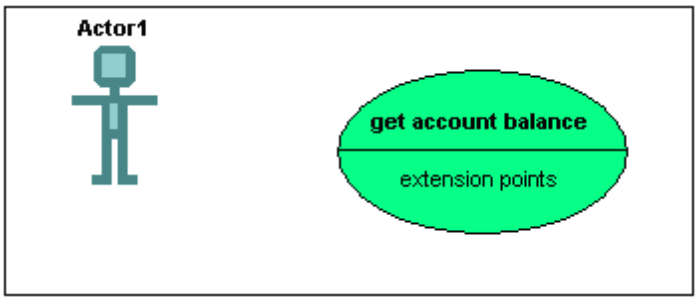
Adding Use case elements to the Use Case diagram:

1. Right click in the newly created diagram and select **New | Actor**.
   The actor element is inserted at the click position.
2. Click the Use Case icon in the icon bar and click in the diagram tab to insert the element.
   A UseCase1 element is inserted. Note that the element, and its name, are currently selected, and that its properties are visible in the Properties tab.



3. Change the title to "get account balance", press Enter to confirm. Double click the title if it is deselected.

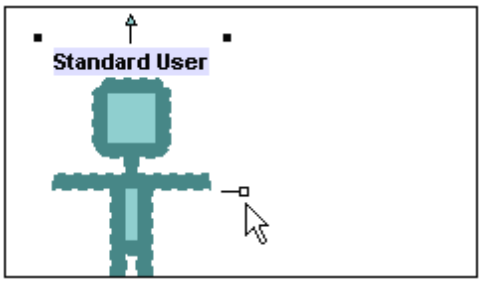
   Note that the use case is automatically resized to adjust to the text length.



Model elements have various connection handles and other items used to manipulate them.
Note: Use CTRL+Enter to create a **multi-line** use case name.

Manipulating UModel elements: handles and compartments

1. Double click the Actor1 text, of the Actor element, change the name to "Standard User" and press Enter to confirm.
2. Place the mouse cursor over the "**handle**" to the right of the actor.
   A tooltip containing "Association" appears.



3. Click the handle, drag the Association line to the right, and drop it on the "get account balance" use case.

   An association has now been created between the actor and the use case. The

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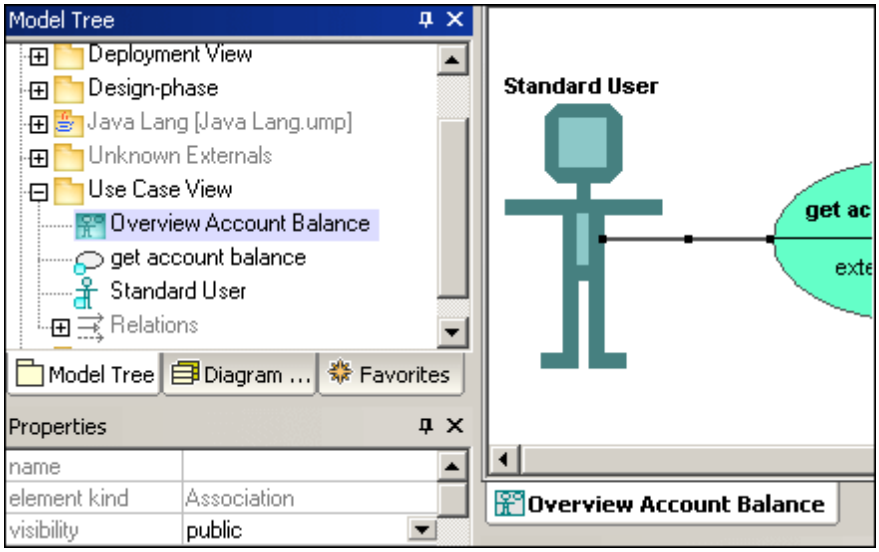
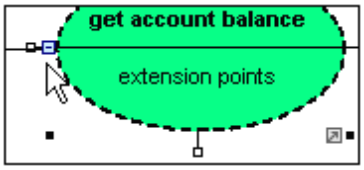
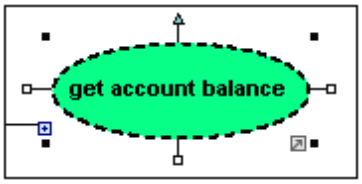
association properties are also visible in the Properties tab. The new association has been added to Model Tree under the Relations item of the Use Case View package.



4. Click the use case and drag it to the right to reposition it.
   The association properties are visible on the association object.
5. Click the use case to select it, then click the **collapse icon** on the left hand edge of the use case ellipse.



The **extension points** compartment is now hidden.



Please note:

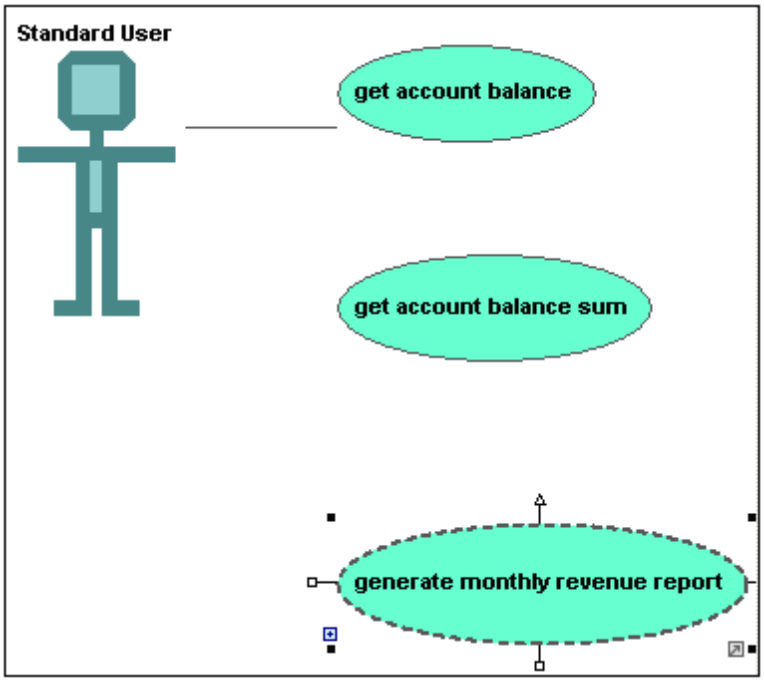
A blue dot next to an element icon

, in the Model Tree tab, signifies that the element is visible in the current diagram tab. Resizing the actor adjusts the text field which can be multi line. A line break can be inserted into the text using CTRL+Enter.

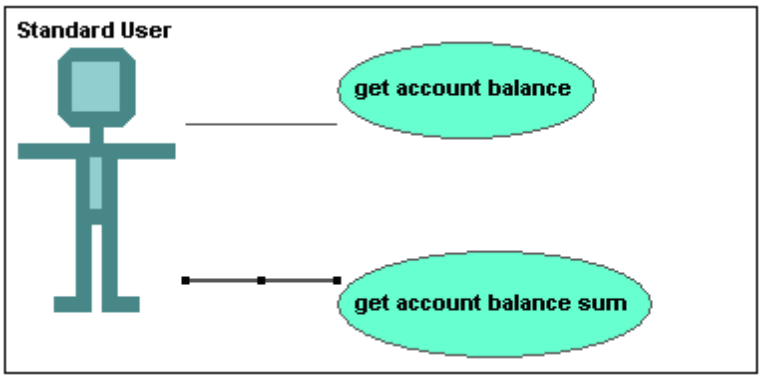
Finishing up the use case diagram:

Using the methods discussed above:

1. Click the Use Case icon in the icon bar and **simultaneously** hold down the CTRL keyboard key.
2. Click at two different vertical positions in the diagram tab to add two more use cases, then release the CTRL key.
3. Name the first use case "get account balance sum" and the second, "generate monthly revenue report".
4. Click on the collapse icon of each use case to hide the extensions compartment.

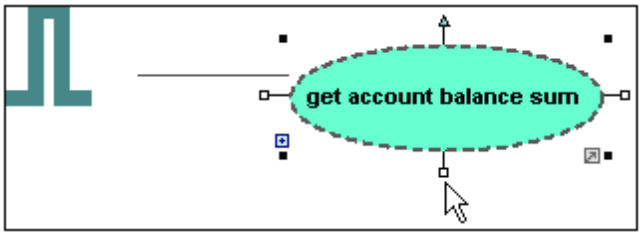


5. Click the actor and use the association handle to create an association between Standard user and "get account balance sum".



To create an "Include" dependency between use cases (creating a subcase):

1. Click the **Include** handle of the "get account balance sum" use case, at the bottom of the ellipse, and drop the dependency on "get account balance".



An "include" dependency is created, and the include stereotype is displayed on the dotted arrow.

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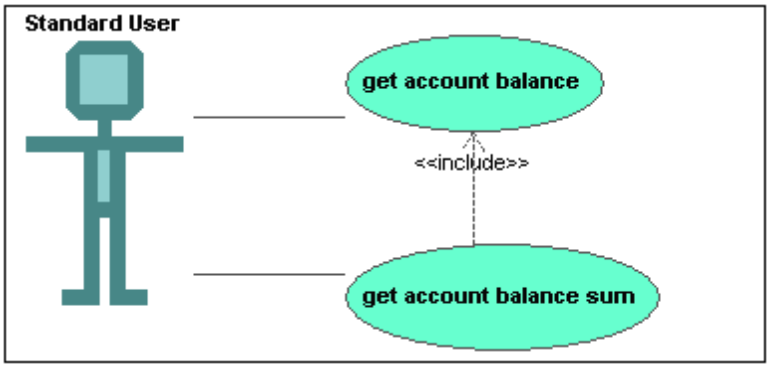
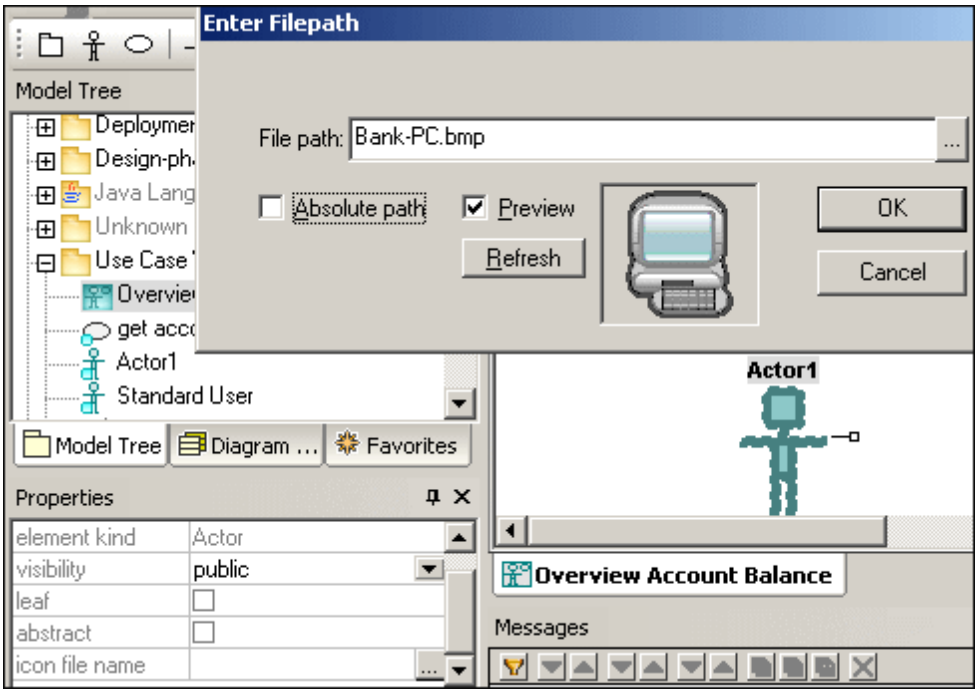


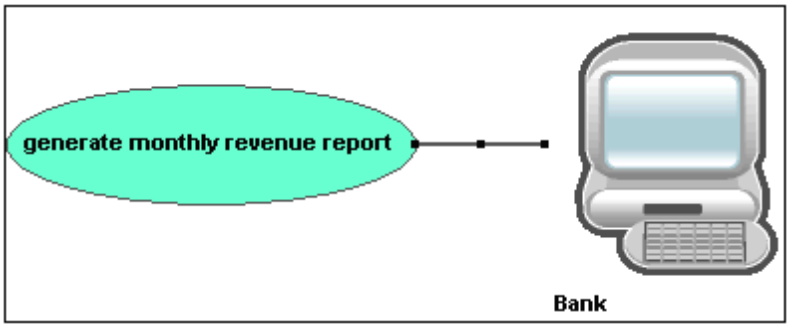
Inserting user-defined / customized actors:

The actor in the "generate monthly revenue report" use case is not a person, but an automated batch job run by a Bank computer.

1. Insert an actor into the diagram using the Actor icon in the icon bar.
2. Rename the actor to Bank.
3. Move the cursor over to the Properties tab, and click the browse ... icon next to the "icon file name" entry.
4. Click the Browse icon to select the user-defined bitmap, Bank-PC.bmp.
5. Deselect the "Absolute Path" check box to make the path relative. Preview displays a preview of the selected file in the dialog box.



6. Click OK to confirm the settings and insert the new actor.
7. Move the new Bank actor to the right of the lowest use case.
8. Click the Association icon → in the icon bar and drag from the Bank actor to the "generate monthly revenue report" use case.
   This is an alternative method of creating an association.

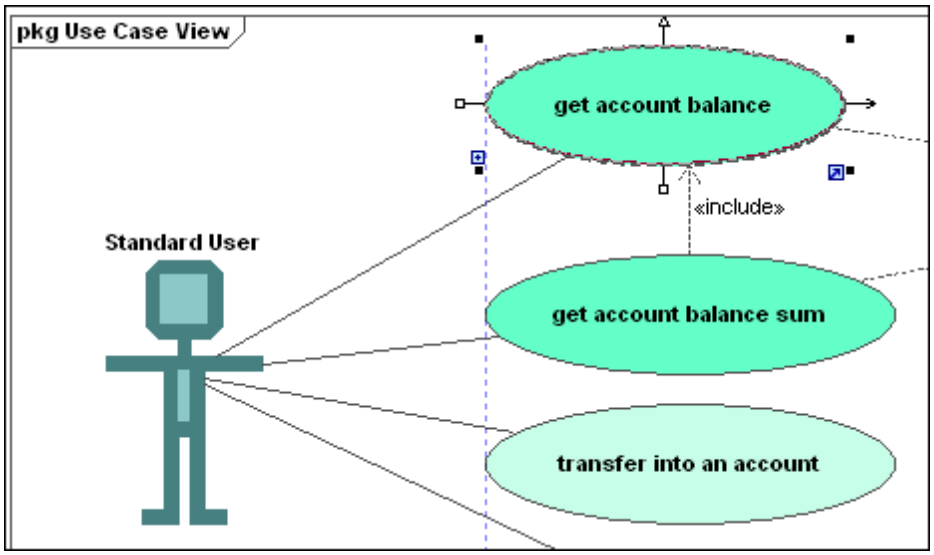


Please note:

The background color used to make the bitmap transparent has the RGB values 82.82.82.

Dragging elements - Snap lines

When dragging components in a diagram, guide lines appear allowing you to align an element to any other element in the diagram. This option can be enabled/disabled using the menu option **Tools | Options | View - Alignment group "Enable Snap lines".**



Aligning and adjusting the size of elements:

1. Create a selection marquee by dragging on the diagram background, making sure that you encompass all three use cases starting from the top.
   Note that the last use case to be marked, is shown in a dashed outline in the diagram, as well as in the Overview window.

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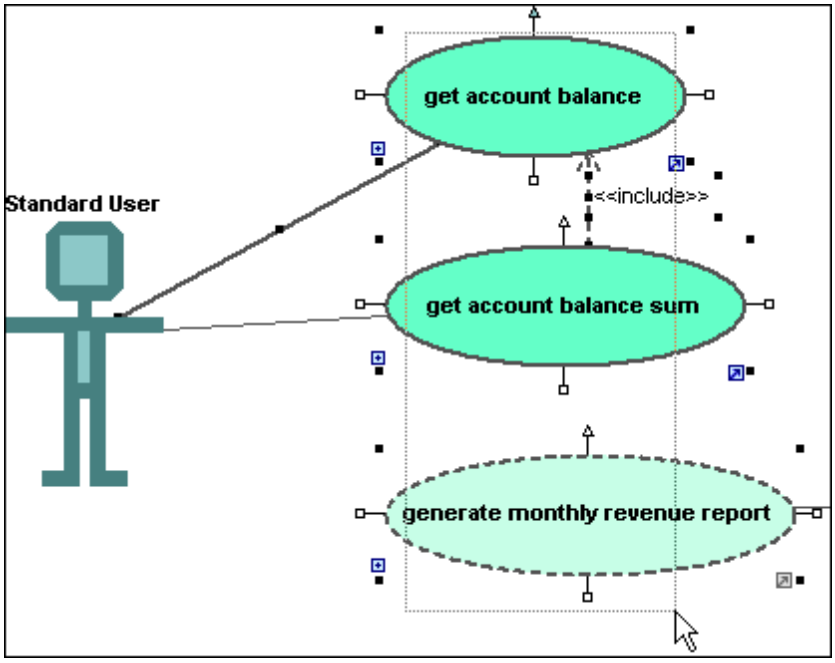
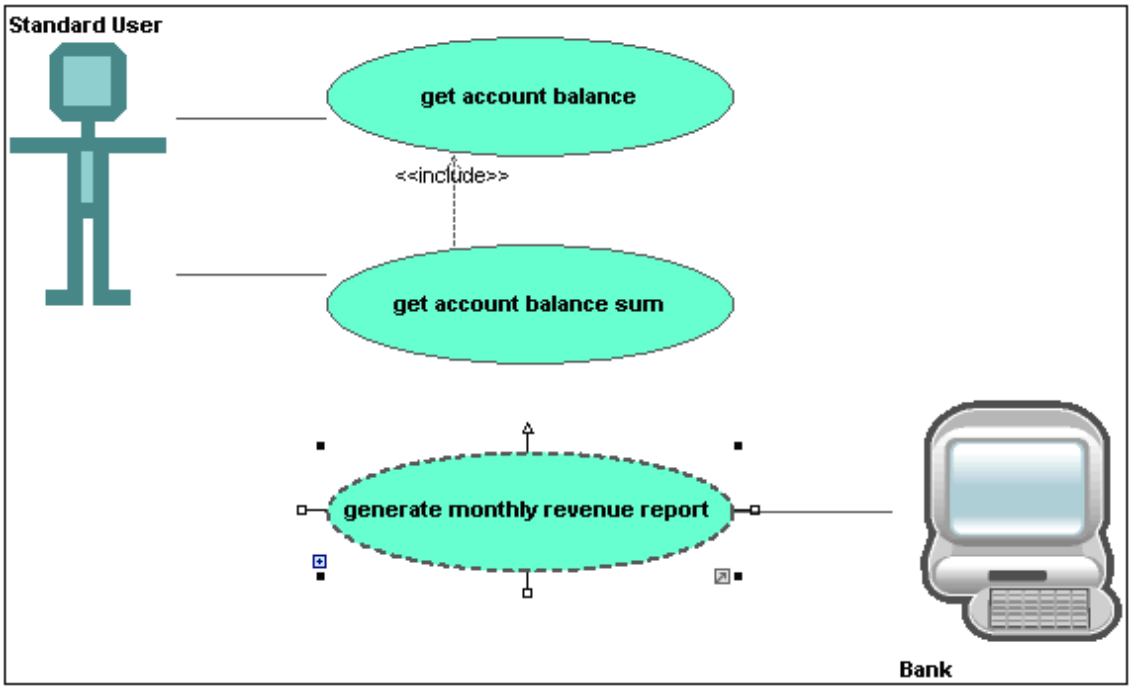


All use cases are selected, with the lowest being the basis for the following adjustments.

2. Click the Make same size icon in the title bar.
3. Click the **Center Horizontally** icon to line up all the ovals.
   The use case elements are all centered and of the same size.

Please note:
You can also use the CTRL key to select multiple elements.



3.3 Class Diagrams

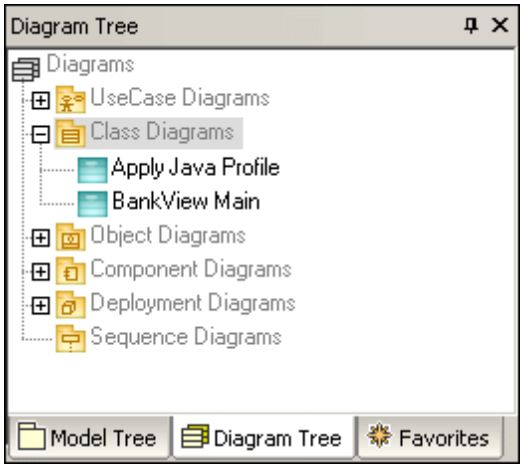
Altova web site: UML Class diagrams

The aim of this tutorial section is to:

- Add a new abstract class called Account, as well as attributes and operations
- Create a **composite** association from Bank to Account

To open a different diagram in UModel:

1. Click the Diagram Tree tab.
2. Expand the Class Diagrams package to see its contents.



All class diagrams contained in the project are displayed.

3. Double click the **BankView Main** diagram icon.
   The Class diagram appears as a tab in the working area.

Please note:
You could of course, double click the Class diagram icon in the Model Tree tab below the BankView package to achieve the same thing.

Two concrete classes with a composite association between them, are visible in the class diagram.

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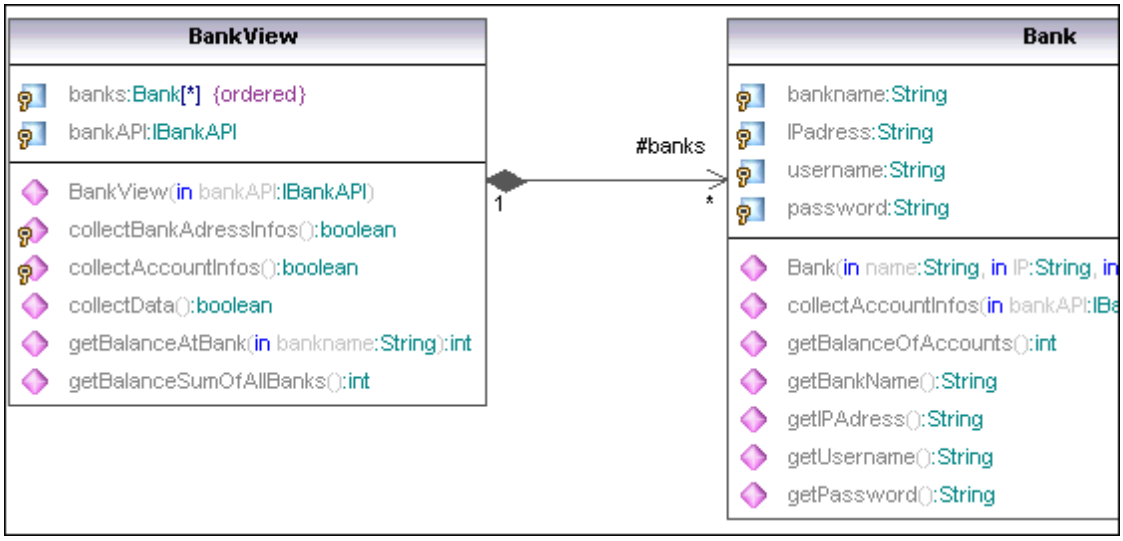
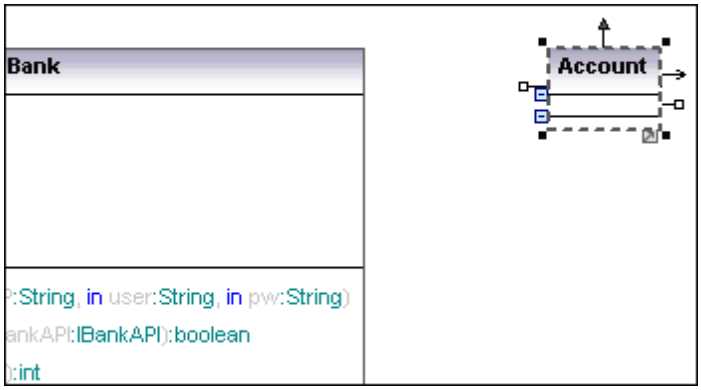


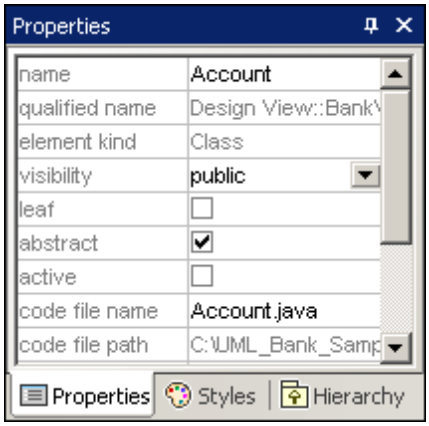
To add a new class and define it as abstract:

1. Click the class icon in the icon bar, then click to the right of the Bank class to insert it.
2. Change the Class1 name to e.g. "**Account**", press Enter to confirm, (double click the name if it becomes deselected).

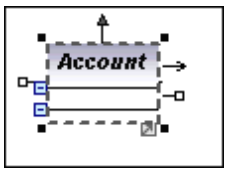


Note that the Properties tab displays the current class properties.

3. Click the "**abstract**" check box in the Properties pane to make the class abstract.
4. Click in the "code file name" text box, and enter **Account.java** to define the Java class.

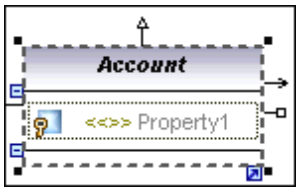


The class title is now displayed in italic, which is the identifying characteristic of abstract classes.

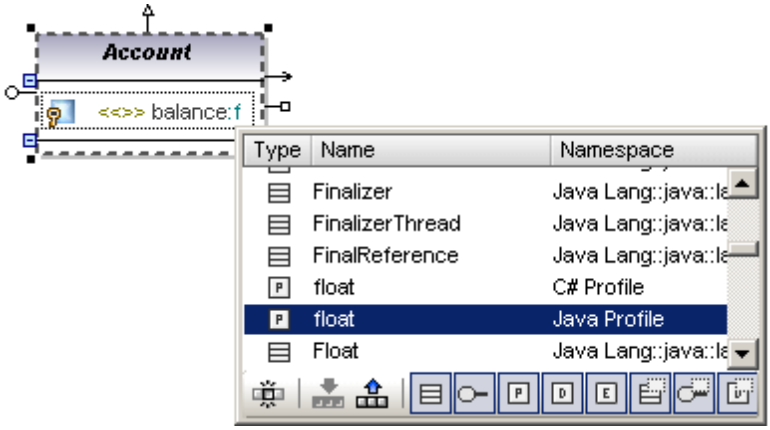


To add properties to a class:

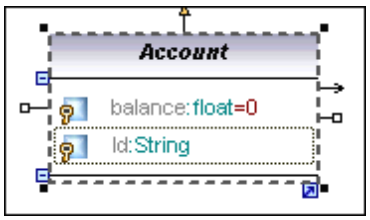
1. Right click the Account class and select **New | Property,** or press the **F7** key**.**
   A default property "Property1" is inserted with stereotype identifiers << >>.



2. Enter the Property name "**balance**", and then add a colon character "**:**".
   A drop-down list containing all valid types is displayed.
3. Enter the "**f**" character through the keyboard, and press Enter to insert the return value datatype "float".
   Please note that drop-down lists are case sensitive!



4. Continue on the same line by appending "**=0**" to define the default value.
5. Press the **F7** keyboard key to add a second property to the class.
6. Enter **Id**: and select **String** from the drop-down list.



To add operations to a class:

1. Right click the Account class and select **New | Operation**, or press the **F8** key.
2. Enter **Account()** as the constructor.
   Using the method described above:

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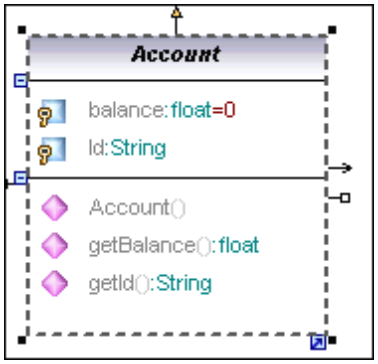
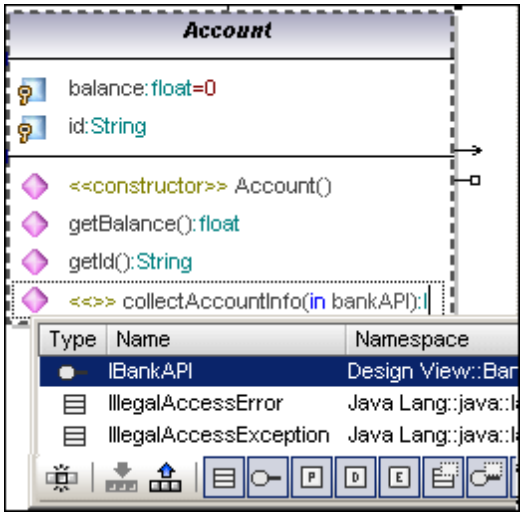
3. Add two more operations namely **getBalance:float** and **getId:String**.

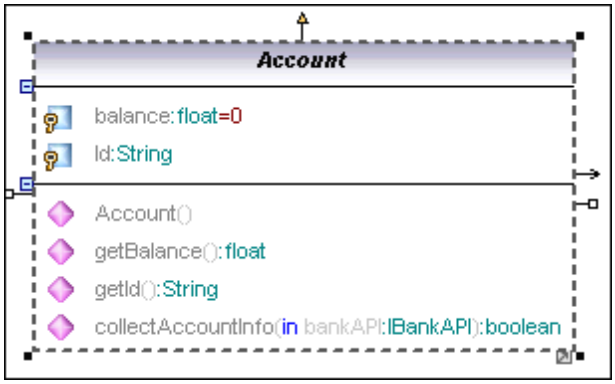


Using the **autocomplete function** while defining operations:

4. Create another operation, using F8, **collectAccountInfo** and enter the open parenthesis character "**(**".
   Entering the "i" character opens the drop-down list allowing you to select one of the operation direction parameters: in, inout, or out.
5. Select "in" from the drop-down list, enter a "space" character, and continue editing on the same line.
6 Enter "bankAPI" and then a colon.
7. Select **IBankAPI** from the drop-down list, add the close parenthesis character "**)**", and enter a colon ":".



8. Press the "b" key to select the boolean datatype, then Enter to insert it.
9. Press Enter to end the definition.



Please note:

Clicking the **visibility icon** to the left of an operation, or property, opens a drop-down list enabling you to change the visibility status. Note that these visibilty icons can be changed to the UML conformant symbols.

Deleting class properties and operations from a Class Diagram:

1. Press F8 then Enter, to add a default operation "Operation1" in the Account class.
2. Click Operation1 and press the **Del**. key to delete it.

   A delete prompt appears asking if you want to delete the element from the project. Click Yes to delete Operation1 from the **class** as well as from the **project**.

Please note:

If you only want to delete the operation from the class in the diagram, but **not** from the **project,** press the **CTRL+Del**. key. You can also enable a prompt that queries you when deleting objects, please see "Tools | Editing" for more information.

Finding (deleting) class properties and options from the Model Tree:

Properties and options can also be deleted directly from the Model Tree. To do this safely, it is important to first find the correct property. Assuming you have inserted "Operation1" in the Account class (press F8, then Enter to insert):

1. Right click Operation1 in the Account class.
2. Select the option "**Select in Model Tree**" or press F4.
   The Operation1 item is now highlighted under *Account* in the Model Tree tab.

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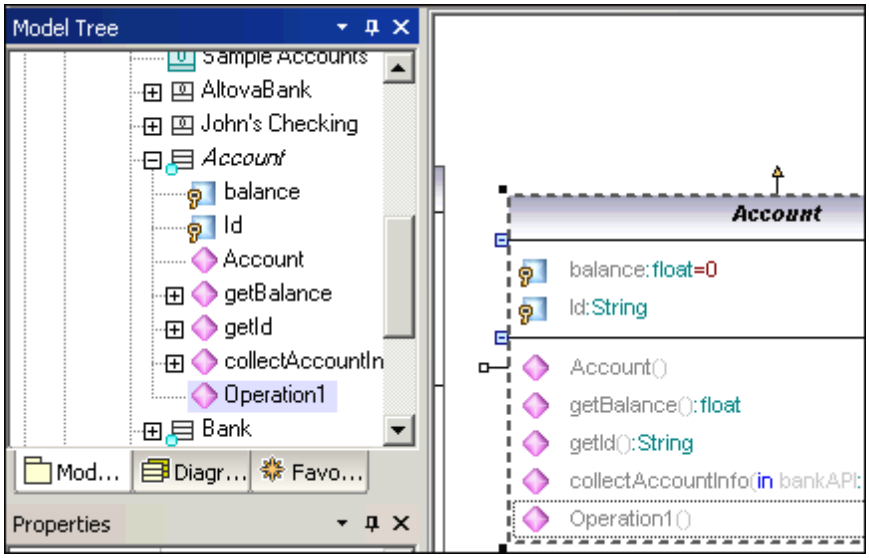
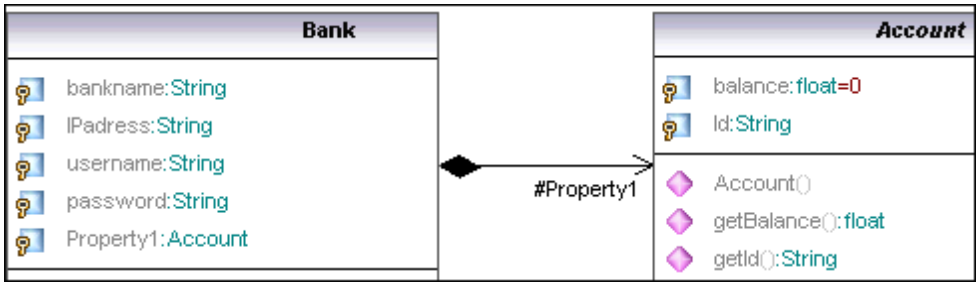


3. Press the **Del** key to delete the operation from the **class** and **project!**
   Note that almost any modeling element can be found in the Model Tree when pressing F4.

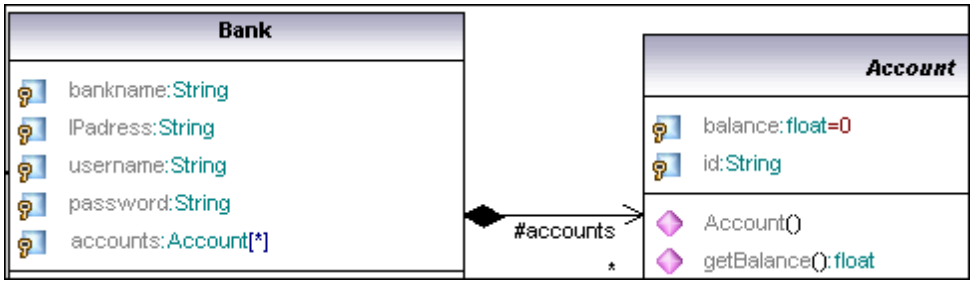
Please note:
It is also possible to navigate from the Properties pane to the Model Tree when viewing an attributes properties, please see: the Properties in the User Interface section.

Creating an composition association between the Bank and Account classes:

1. Click the Composition icon in the title bar, then drag from the **Bank** class to the **Account** class. The class is highlighted when the association can be made.
   A new property (**Property1:Account**) is created in the Bank class, and an composite association arrow joins the two classes.



2. Double click the new **Property1** entry in the Bank class and change it to "**accounts**", being sure not to delete the Account type definition (displayed in teal/green).
3. Press the End keyboard key to place the text cursor at the end of the line, and
4. Enter the open square bracket character "**[**" and select "*****" from the dropdown list, to define the **multiplicity**, and press Enter to confirm.



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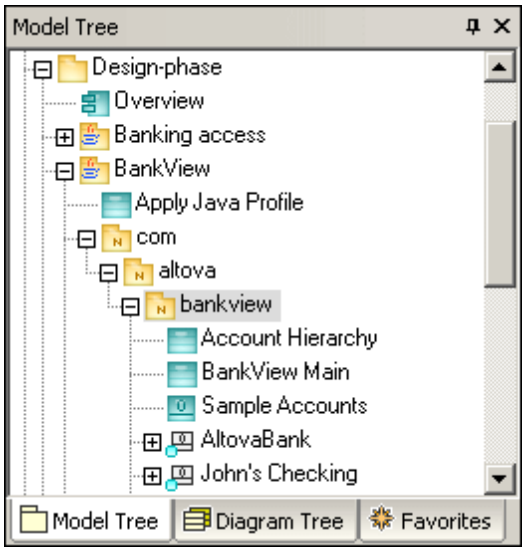
3.3.1 Creating derived classes

The aim of this tutorial section is to:

- Add a new **Class diagram** called Account Hierarchy to the project
- Insert existing classes, and create a new Savings account class
- Create three **derived** classes of the abstract base class Account, using Generalizations

To create a new Class Diagram:

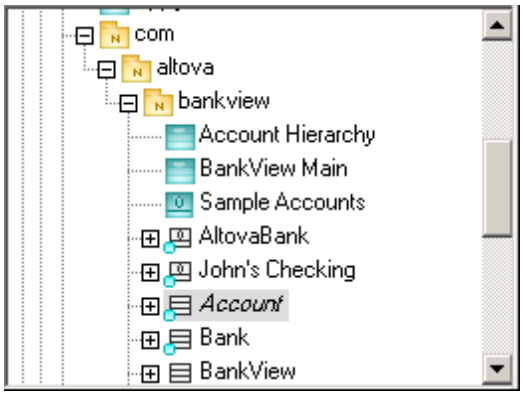
1. Right click the bankview **package** (under **Design-phase | BankView | com | altova**) in the Model Tree tab, and select **New Diagram | Class Diagram.**
2. Double click the new ClassDiagram1 entry and rename it to "Account Hierarchy", and press Enter to confirm.



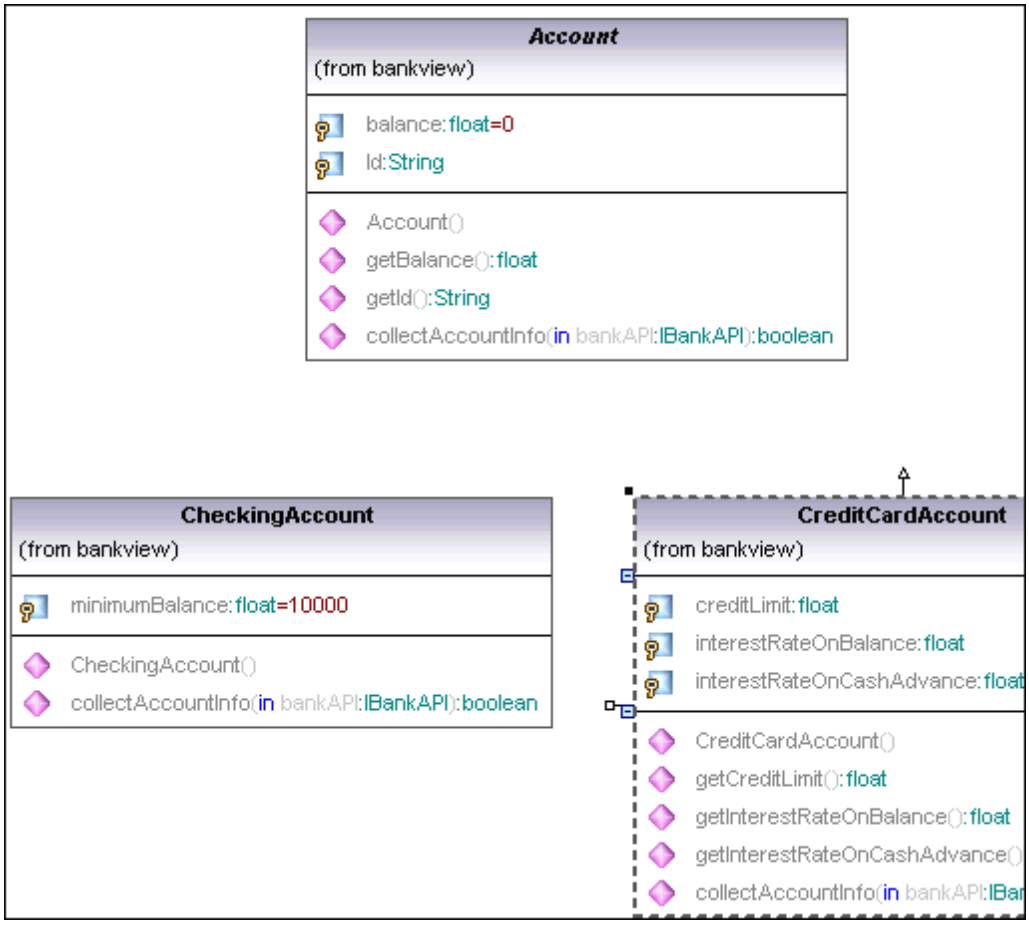
The Account Hierarchy tab is now visible in the working area.

Inserting existing classes into a diagram:

1. Click the *Account* **class** in the bankview **package** (under **com | altova | bankview**), and

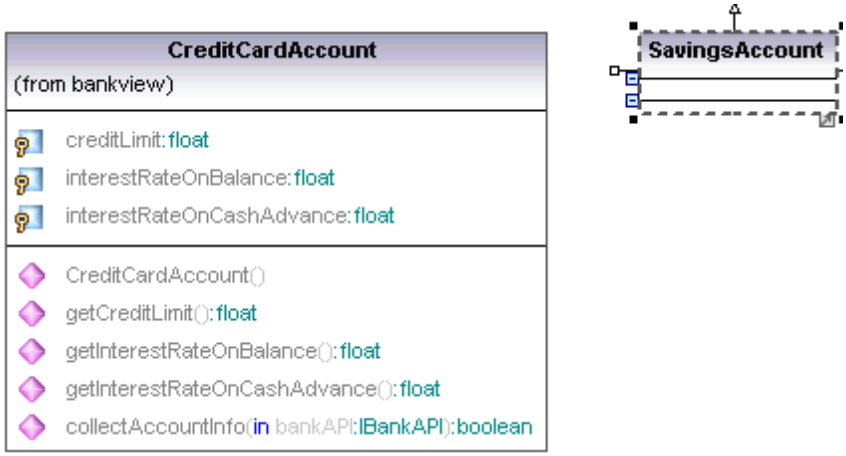


2. Drag it into the Account Hierarchy tab.
3. Click the **CheckingAccount** class (of the same package) and drag it into the tab.
4. Place the class below and to the left of the Account class.
5. Use the same method to insert the **CreditCardAccount** class. Place it to the right of the CheckingAccount class.



Adding a new class:

1. Right click the diagram background (to the right of CreditAccountClass) and select **New | Class**.
   A new class is automatically added to the correct package, i.e. bankview which contains the current class diagram **Account Hierarchy**.
2. Double click the class name and change it to **SavingsAccount**.



3. Press the **F7** key to add a new **property**.
4. Enter "**interestRate**", then a colon, and press "**f**" to select the float datatype from the

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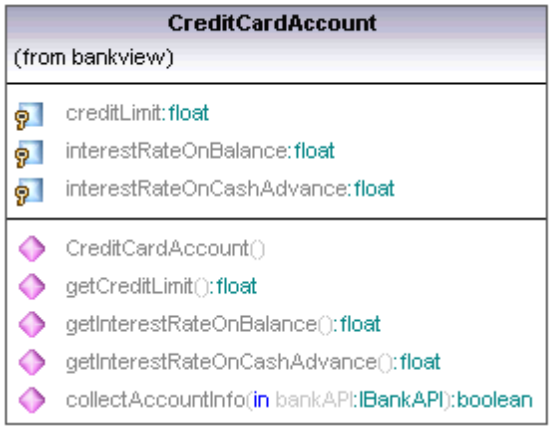
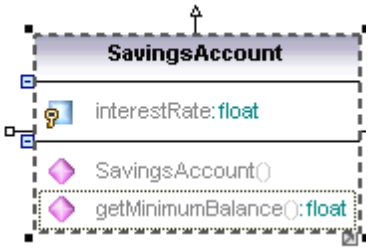
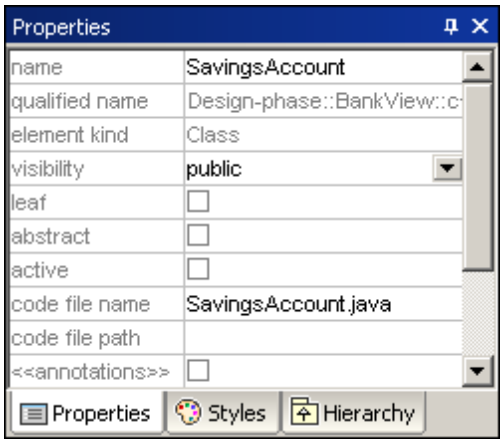
dropdown list and press Enter twice to select and confirm the entry.

5. Press **F8** and add the **operation**/constructor **SavingsAccount()**.
6. Use the same method, F8, to add the operation **getMinimumBalance:float**.





7. Click in the "code file name" text box, in the Properties tab, and enter **SavingsAccount.java** to define the Java code class.

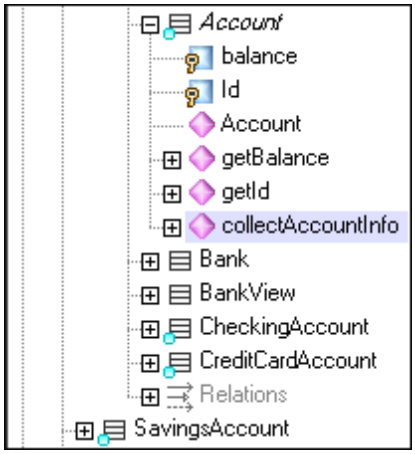


Reusing/copying existing Properties/Operations:

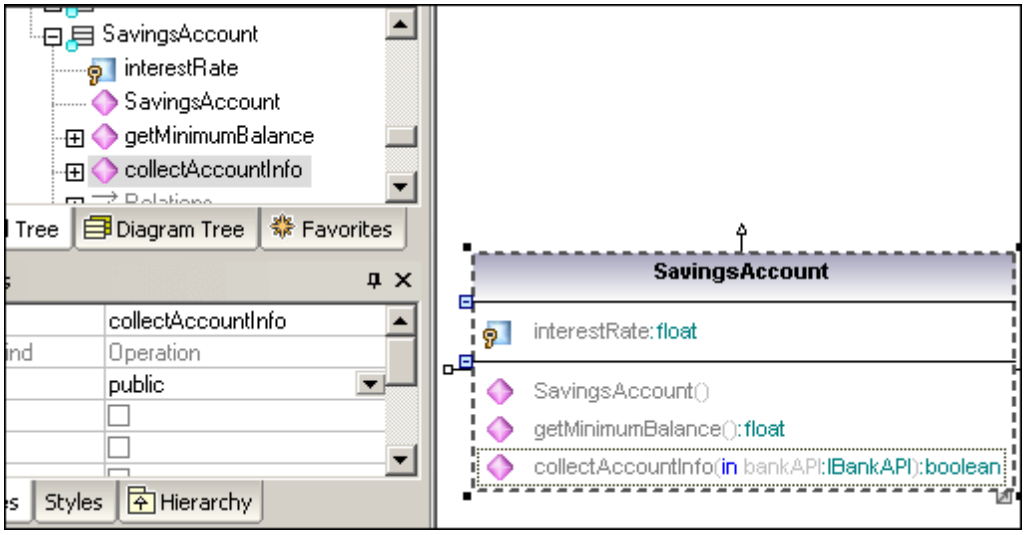
Properties and operations can be directly copied, or moved, from one class to another. This can be achieved using drag and drop, as well as the standard keyboard shortcuts:

- within a **class** in the diagram tab
- between **different** classes in the diagram tab
- in the Model Tree view
- between different UML diagrams, by dropping the copied data onto a different diagram tab.
  Please see "Cut, copy and paste in UModel Diagrams" for more information.

1. Expand the ***Account*** class in the **Model Tree**.
2. Right click the **collectAccountInfo** operation and select **Copy**.



3. Right click the **SavingsAccount** class in the Model Tree and select **Paste**.
   The operation is copied into the SavingsAccount class, which is automatically expanded to display the new operation.



   The new operation is now also visible in the SavingsAccount class in the Class Diagram.

Please note:

You can use the Copy/Paste keyboard shortcuts (CTRL C, or V), as well as drag and drop in the Model Tree to achieve the same effect. You might have to disable the sort options to drop the operation between specific items.

Creating derived classes - Generalization/Specialization:

At this point the class diagram contains the abstract class, Account, as well as three specific Account classes. We now want to define, or create a generalization/specialization relationship between Account and the specific classes i.e. to create three derived concrete classes.

1. Click the Generalization icon in the icon bar and **hold down** the **CTRL** key.
2. Drag from **CreditCardAccount** (the class in the middle) and drop on the Account class.
3. Drag from the **CheckingAccount** class and drop the **arrowhead** of the previously created generalization.
4. Drag from the **SavingsAccount** class and drop the arrowhead of the previously created

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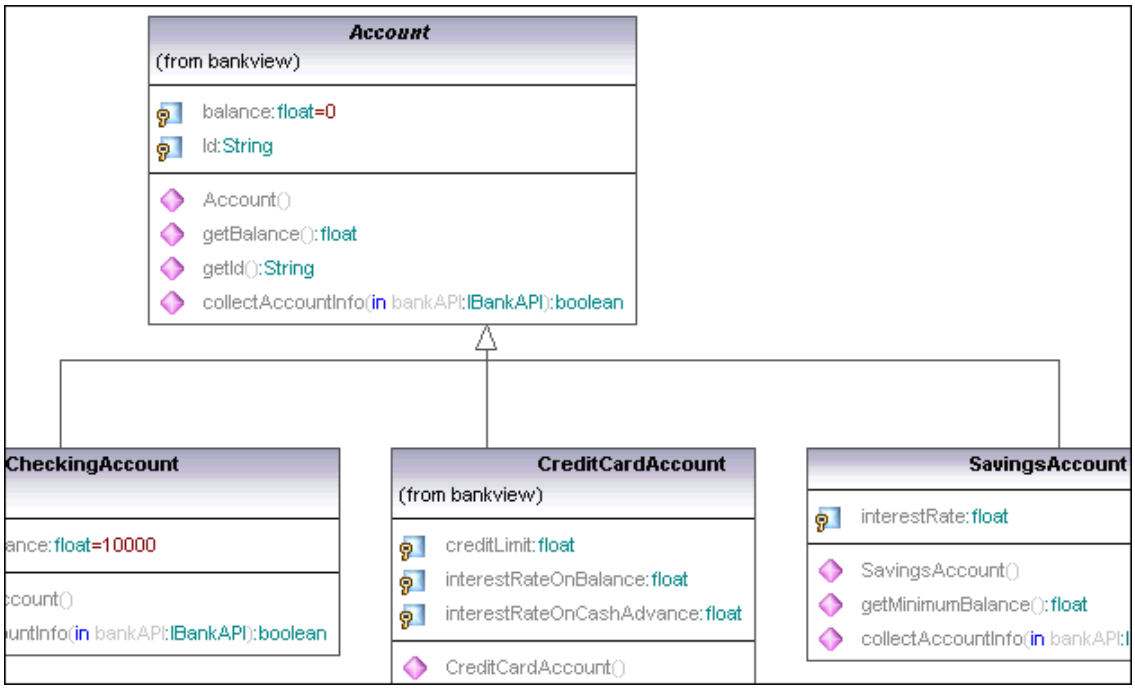
generalization: release the CTRL key at this point.

5. Generalization arrows are created between the three subclasses, and the Account superclass.



3.4 Object Diagrams

Altova web site: UML Object diagrams

The aim of this tutorial section is to:

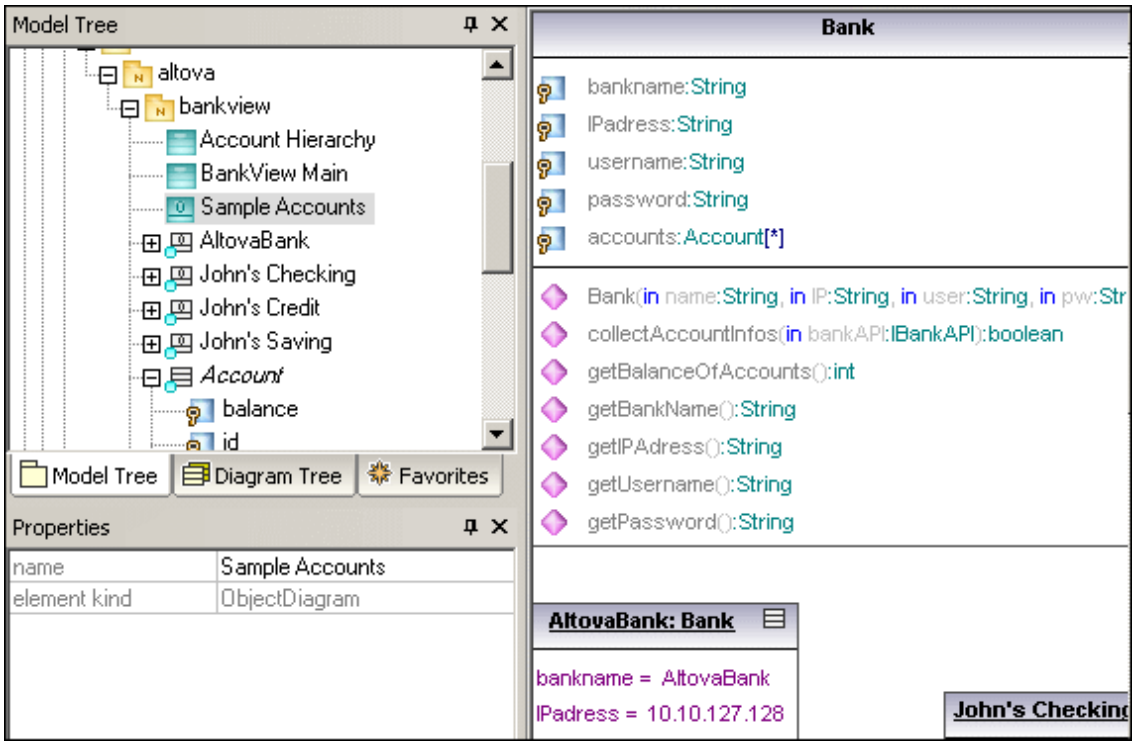
- Show how **class** and **object** diagrams can be combined in one diagram, to give you a snapshot of the objects at a given point of time
- Create **Objects/Instances** and define the relationships between them
- Format association/links
- Enter real-life data into objects/instances

To open the Object diagram:

1. Double click the **Sample Accounts** diagram icon under the **bankview** package (or under Object Diagrams in the Diagram Tree tab).

   The Bank class and two related objects/instances are displayed in the object diagram.

   AltovaBank:Bank is the object/instance of the Bank class, while **John's checking: CheckingAccount** is an instance of the class CheckingAccount.



Inserting a class into an Object diagram:

- Click the *Account* class icon *Account* in the **Model Tree**, and drag it into the "Sample Accounts" tab.
  The composite association defined previously, in BankView Main diagram, is automatically created.

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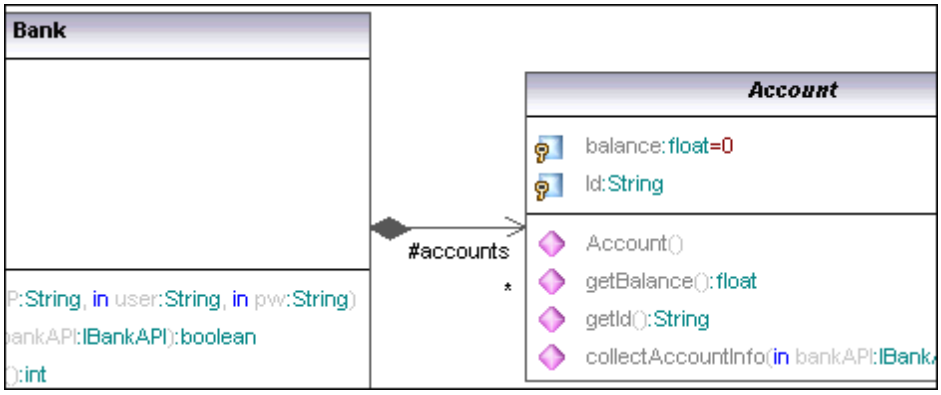
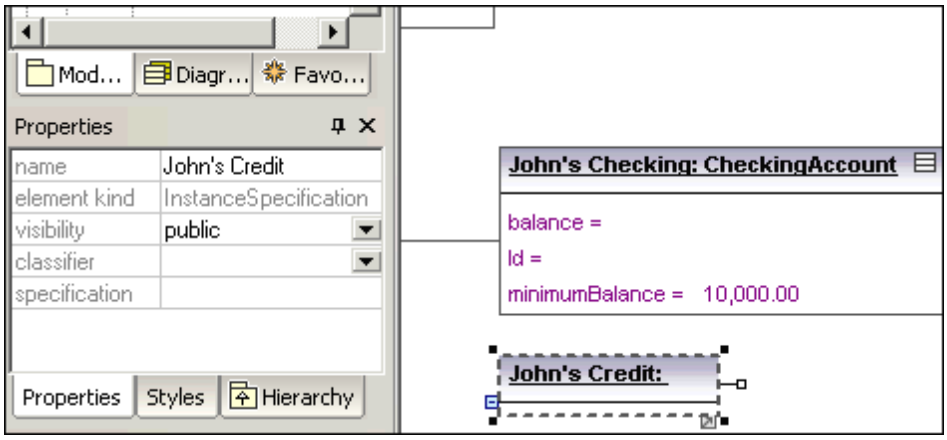


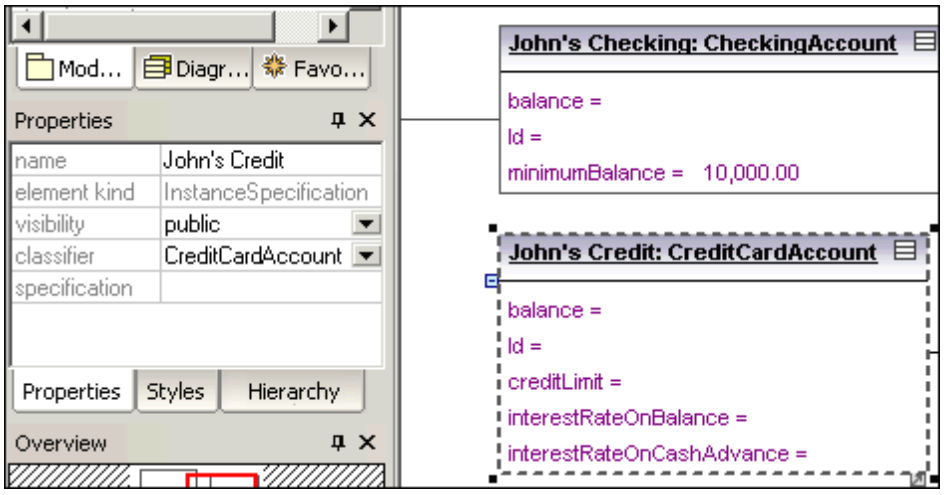
To add a new object/instance by selecting its type:

1. Click the **InstanceSpecification** icon in the icon bar, then click under the John's Checking object in the diagram tab.
2. Change the name of the instance to **John's Credit**, and press Enter.



While the instance is active, all its properties are visible in the Properties tab.

3. Click the **classifier** combo box and select the entry **CreditCardAccount** from the drop-down list.

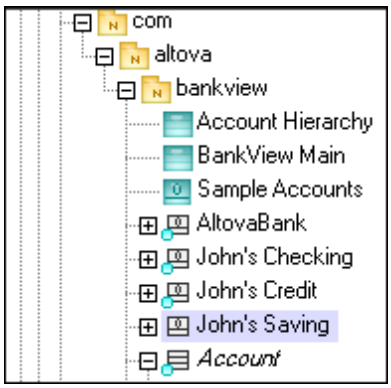


Note that right clicking an instance specification and selecting **Show/Hide Node**

content allows you show/hide object content.

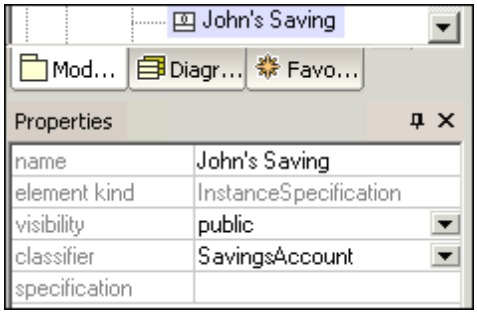
To add a new object in the Model Tree view (then insert it into a diagram):

1. Right click the **bankview** package in the **Model Tree tab**, and select **New element | InstanceSpecification**.
2. Change the default object name to **John's Saving**, and press Enter to confirm.
   The new object is added to the package and sorted accordingly.

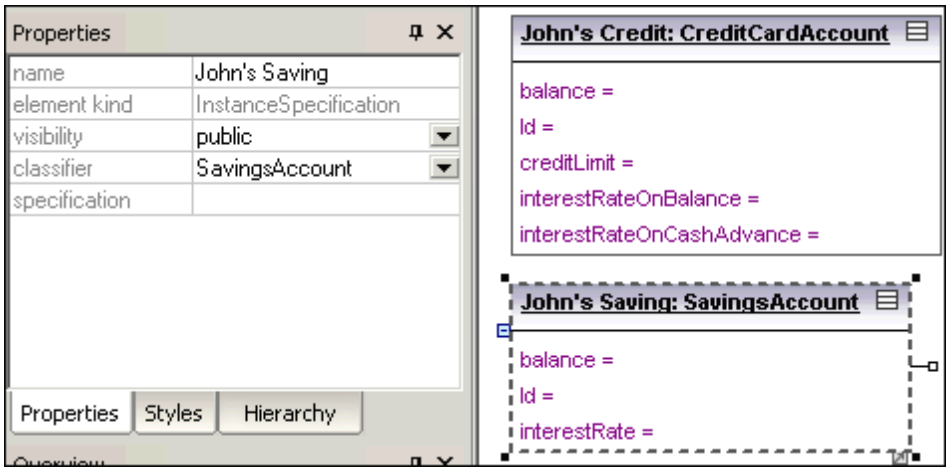


While the object is still selected in the Model Tree tab,

3. Click the **classifier** combo box, in the **Properties** tab, and select **SavingsAccount**.



4. Drag the John's Saving object/instance from the Model Tree tab, into the Sample Accounts tab, placing it below John's credit.



Creating "links" between objects:

Links are the instances of class associations, and describe the relationships between objects/

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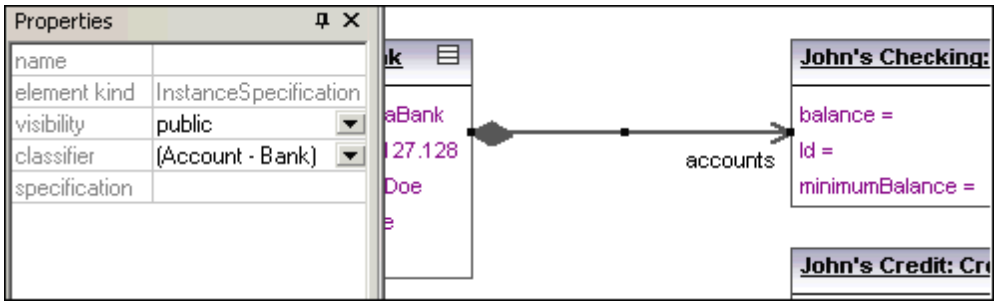
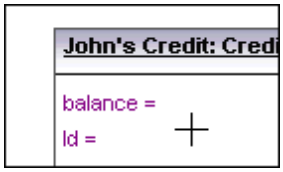
instances at a fixed moment in time.

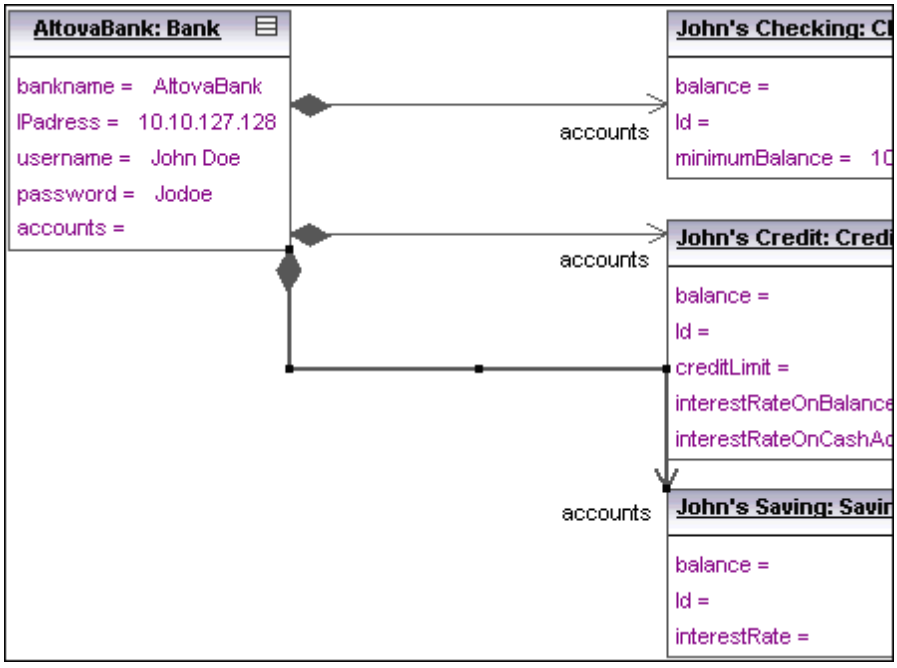
1. Click the existing link (association) between the **AltovaBank** and John's Checking.
2. In the Properties tab, click the **classifier** combo box and select the entry **Account - Bank.**
   The link now changes to a composite association, in accordance with the class definitions.



3. Click the **InstanceSpecification** icon in the icon bar, and position the cursor over the John's Credit class.
   The cursor now appears as a + sign.



4. Drag from **John's Credit** object to AltovaBank to create a link between the two.
5. Use the **classifier** combo box in the Properties tab to change the link type to **Account - Bank**.
6. Use the method outlined above to create a link between **John's Saving** and AltovaBank.

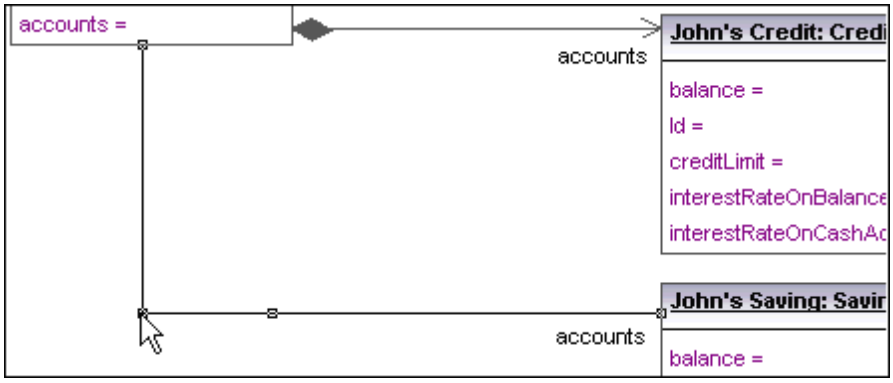


Please note:

Changes made to the association type in any class diagram, are now automatically updated in the object diagram.

Formatting association/link lines in a diagram:

1. Click the lowest link in the diagram, if not active, and drag the corner connector to the left.
   This allows you to reposition the line both horizontally and vertically.

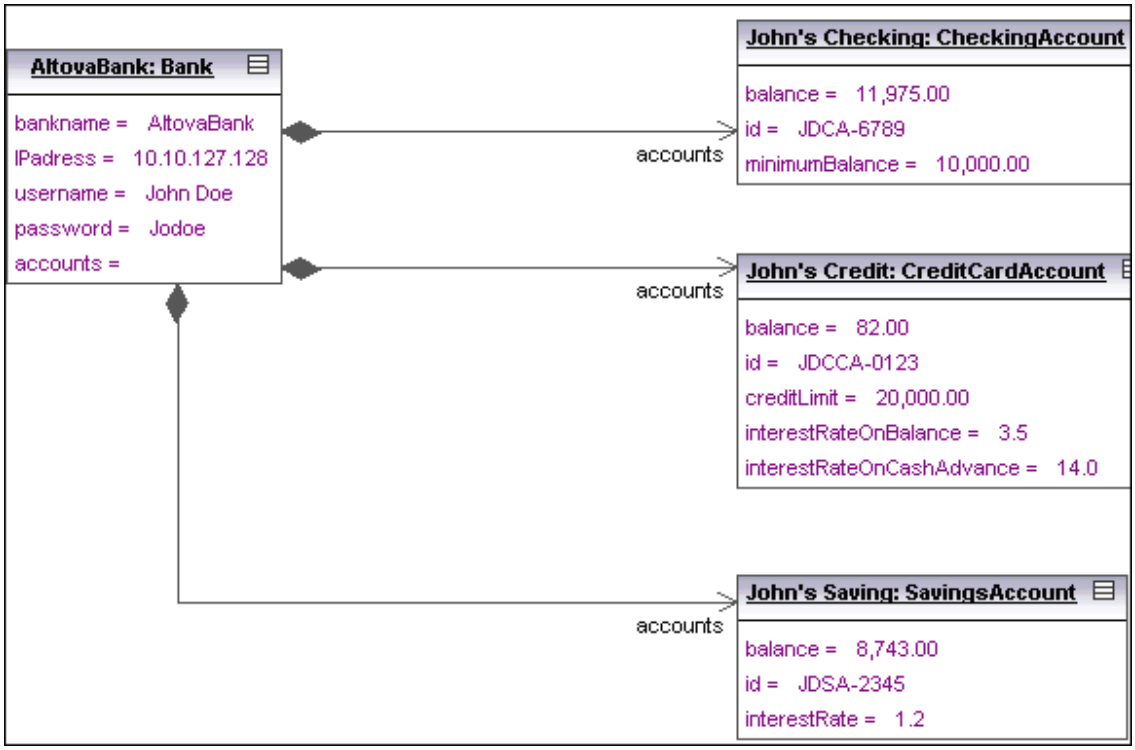


Use this method to reposition links in the diagram tab.

Entering sample data into objects:

The instance value of an Attribute/Property in an object is called a **slot**.

1. Click in the respective slots of each object and enter sample data.
2. E.g. in **John's Checking** object, double click in the **balance** slot and enter 11,975.00 as the balance.
3. Fill in the rest of the data to give yourself an idea of the current instance state.



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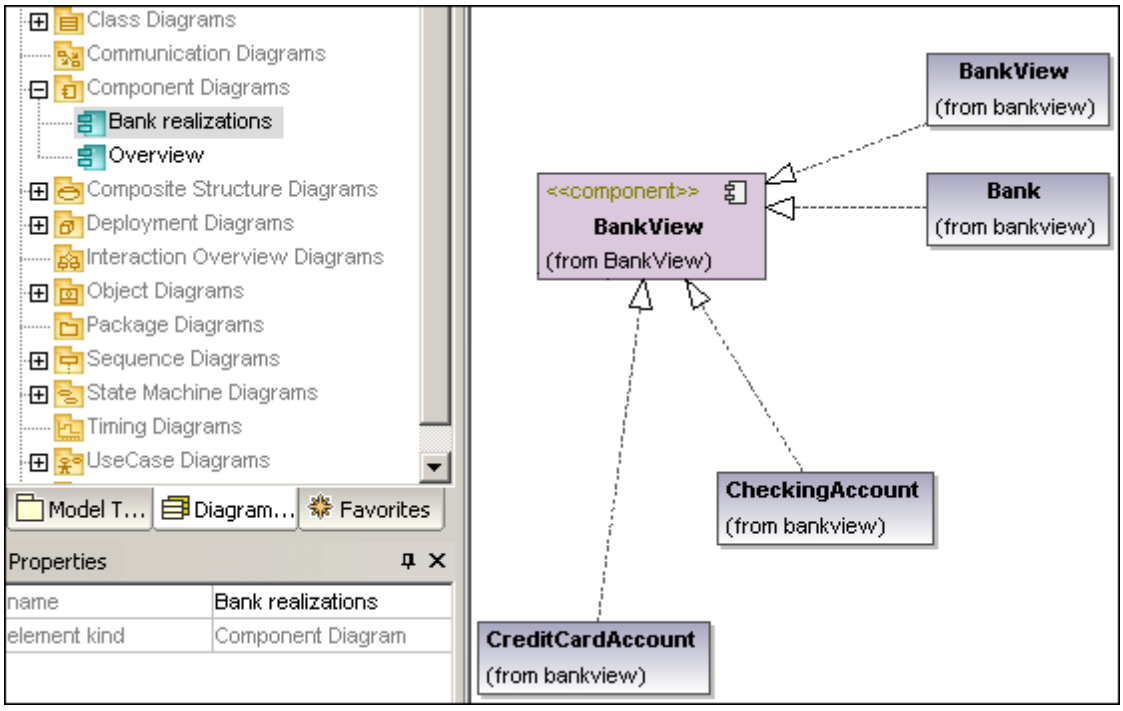
3.5 Component Diagrams

The aim of this tutorial section is to:

- Show how to insert classes into a component diagram
- Create realization dependencies between the classes and the BankView component
- Show how to change line properties
- Insert components into a component diagram, and create usage dependencies to an interface

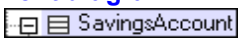
To open the component diagram:

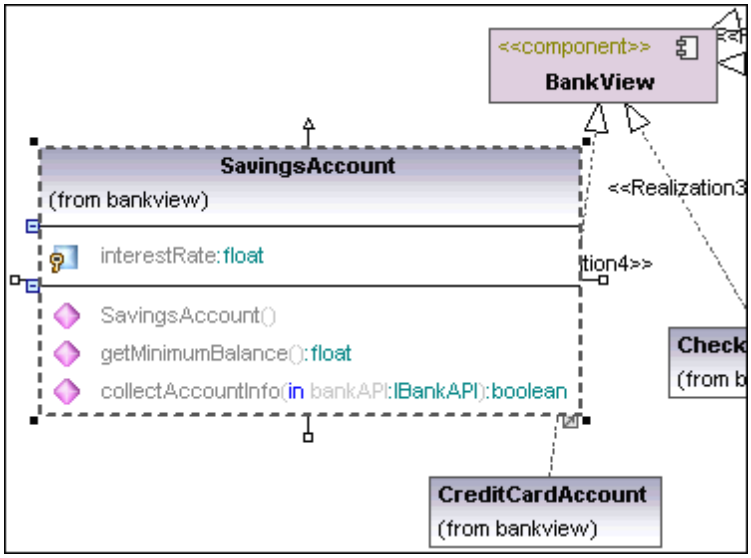
1. Click the Diagram Tree tab, expand the **Component Diagrams** component and double click the "BankView realization" diagram icon.
   The "BankView realization" component diagram is displayed.



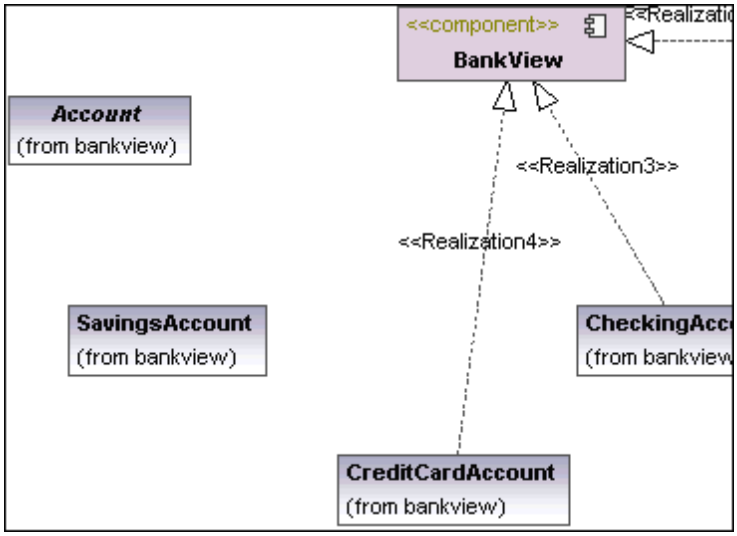
2. Switch back to the Model Tree tab by clicking that tab.

To insert (existing) classes into a component diagram:

1. Locate the **SavingsAccount** class  under the bankview package.
2. Drag it into the component diagram.
   The class is displayed with all its compartments.



3. Click both collapse icons to end up with the only the class name compartment.
4. Use the same method to insert the abstract class **Account**.



Please note:

The package containing the inserted class, is displayed in the name compartment in the form "from bankview".

To create Realization dependencies between a class and component:

1. Click the Realization icon in the icon bar.
2. Drag from **SavingsAccount**, and drop the arrow on the **BankView** component.

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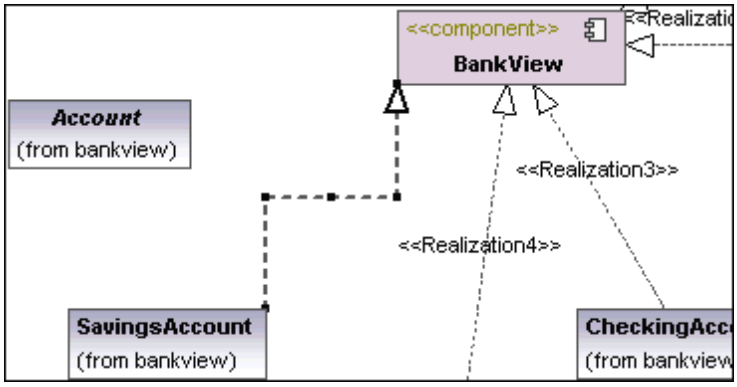
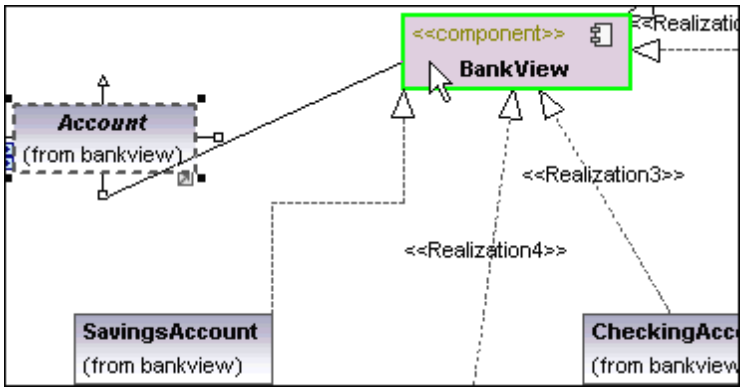


3. Click the **ComponentRealization** handle of the Account class (at the base), and drop it on the BankView component.

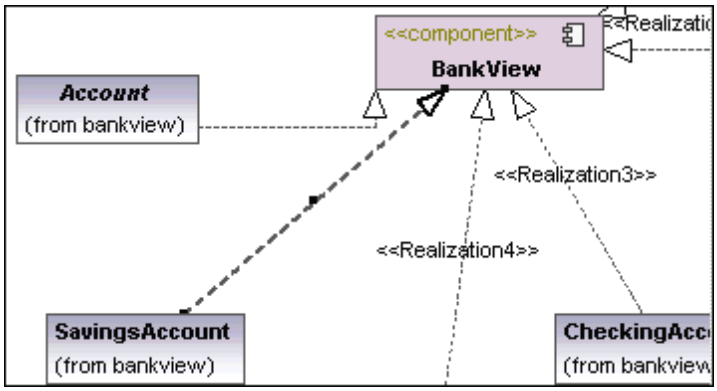


Both of these methods can be used to create realization dependencies. There is another method that allows you to create realization dependencies solely in the Model Tree, please see Round-trip engineering (code - model - code) for more information.

Changing (Realization) line characteristics:

Clicking a dependency or any other type of line in a UModel diagram, activates the line drawing icons in the Layout icon bar.

1. Click the realization line between **SavingsAccount** and BankView.
2. Click the line type icon **Direct line** in the Layout toolbar.

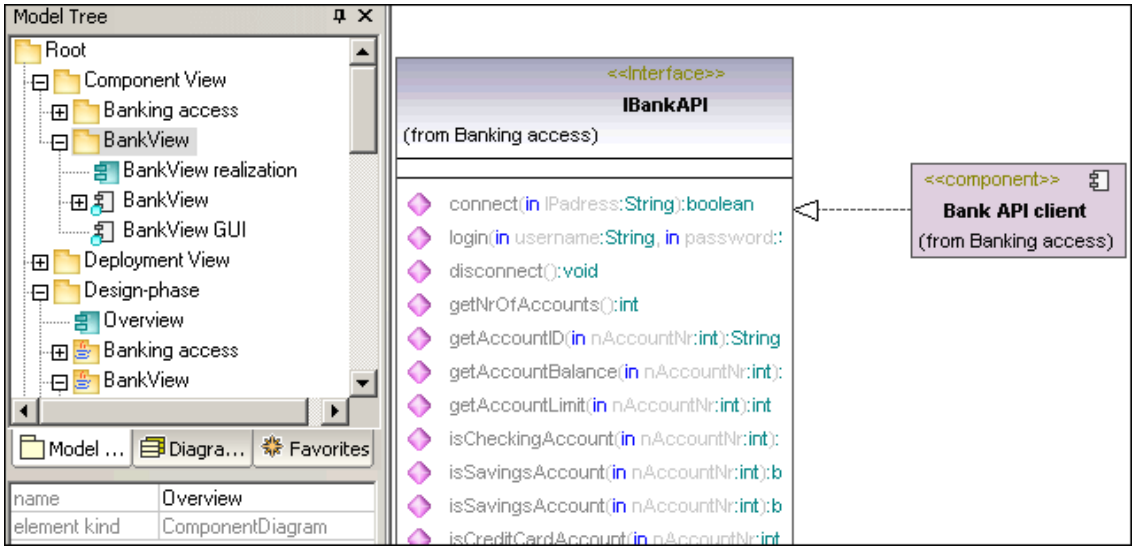


The line properties are immediately altered. Lines have small icons along them called **waypoints**. Waypoints can be clicked and moved to alter line characteristics. Change

the line properties to suit your needs.

Inserting components and creating usage dependencies:

1. Double click the **Overview** diagram icon directly under the **Design-phase** package in the Model Tree.
   The Overview component diagram is opened and displays the currently defined system dependencies between components and interfaces.



2. Click the **BankView GUI** component under the **Component View | BankView** package in the Model Tree, and drag it into the **Overview** diagram tab.
   The package containing the inserted component is displayed in the name compartment, "from BankView".
3. Use the same method to insert the **BankView** component under the same package.

The BankView component is the component produced by the "forward-engineering" process described in this tutorial.

To create a usage dependency between interfaces and components:

1. Click the Usage icon in the icon bar.
2. Drag from the **BankView GUI** component to the **BankView** component.
3. Click the Usage icon again, and drag from the **BankView** component to the **IBankAPI** interface.

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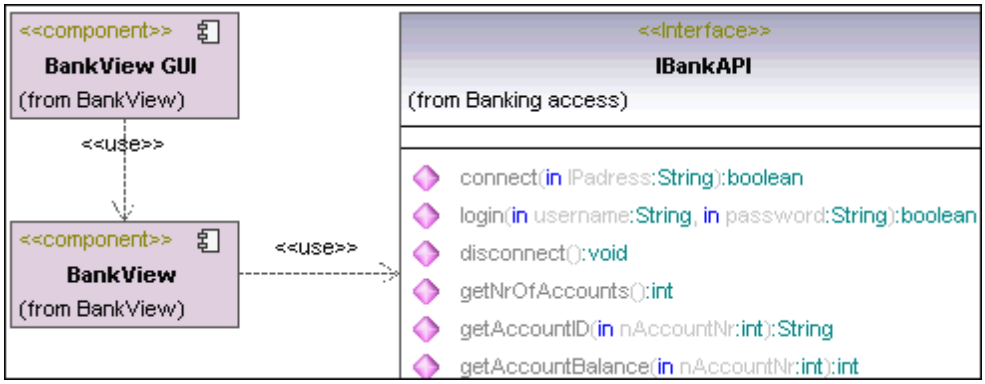


The usage dependency (<<use>>) connects a **client** element to a **supplier** element. In this case the IBankInterfaceAPI interface uses the services of components BankView and BankView GUI.

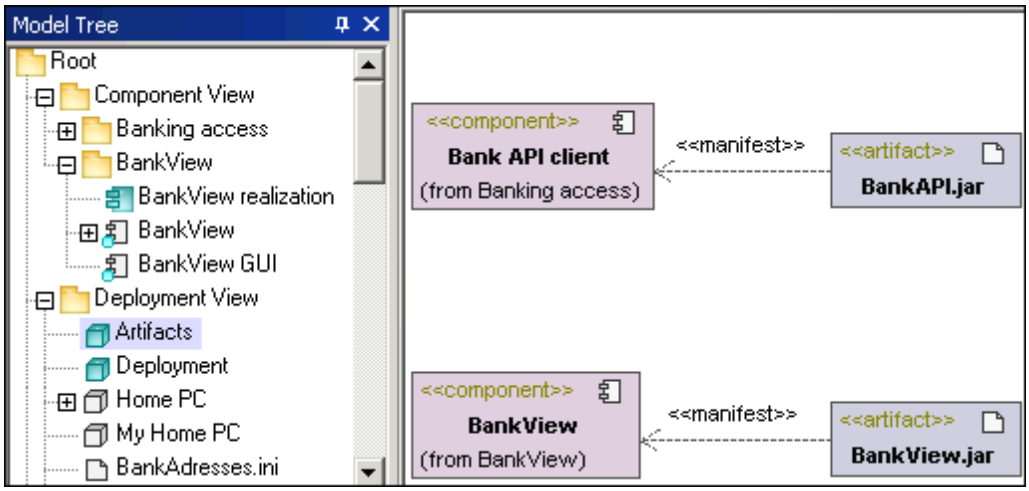
3.6 Deployment Diagrams

The aim of this tutorial section is to:

- Show the artifact manifestation of components
- Add a new node and dependency to a Deployment diagram
- Add artifacts to a node and create relationships between them

To open the Deployment (Artifacts) diagram:

1. Click the Model Tree tab, expand the **Deployment View** diagram package, then double click the **Artifacts** icon.



This diagram shows the manifestation of the **Bank API client** and the **BankView** components, to their respective compiled Java **.jar** files.

To open the Deployment diagram:

1. Double click the **Deployment** icon under the Deployment View package.
   The Deployment diagram is opened and displays the physical architecture of the system, which currently only comprises of the Home PC node.

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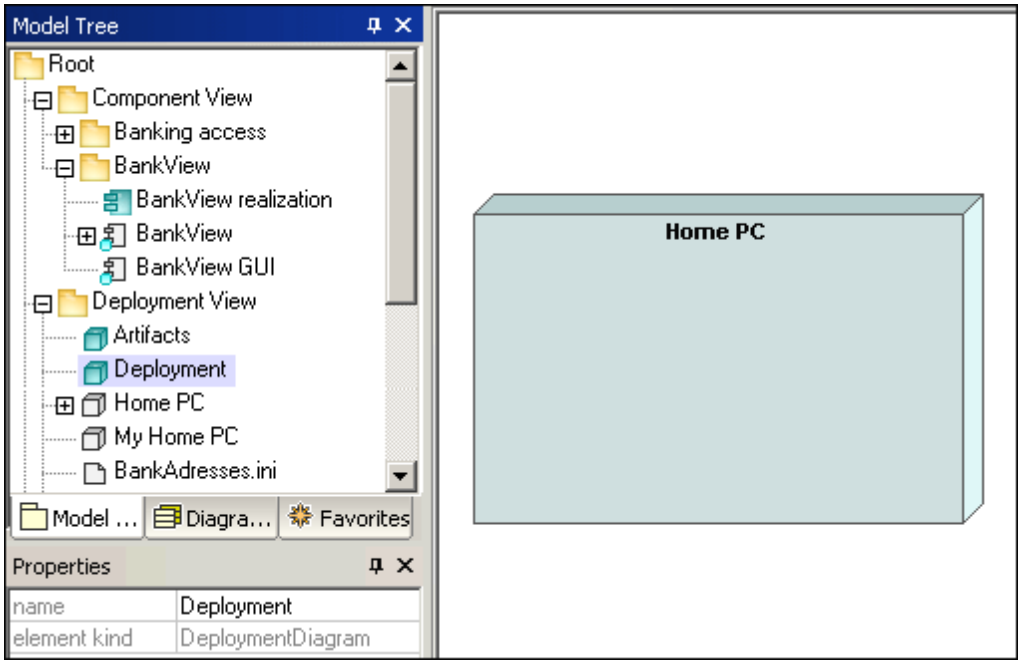
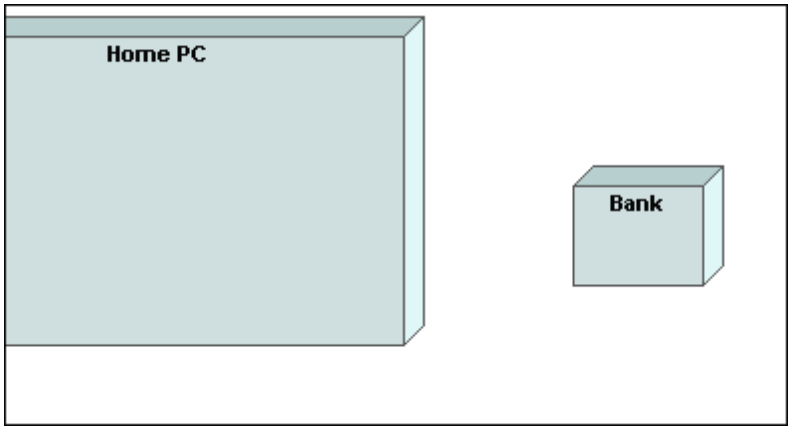


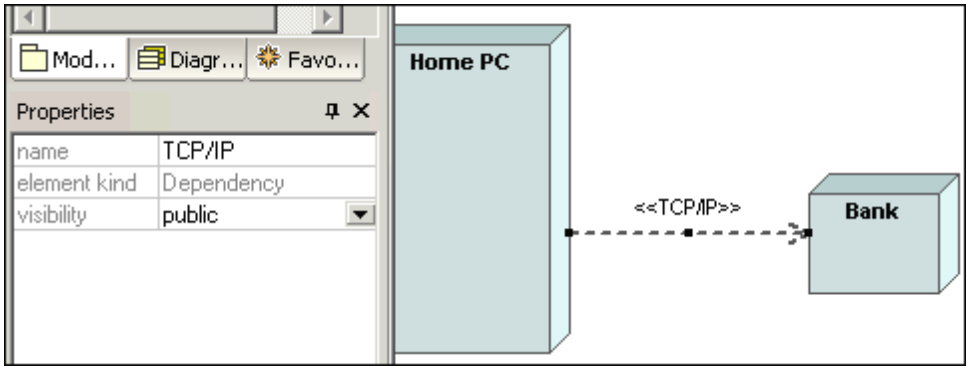
To add a Node to a Deployment diagram:

1. Click the Node icon in the icon bar, and click right of the Home PC node to insert it.
2. Rename the node to Bank, and drag on one of its edges to enlarge it.



To create a dependency between two nodes:

1. Click the dependency icon , then drag from the **Home PC** node to the **Bank** node. This creates a dependency between the two nodes.
2. Click into the **name** field of the Properties tab, change it to **TCP/IP**, and press Enter to confirm.
   The dependency name appears above the dependency line.



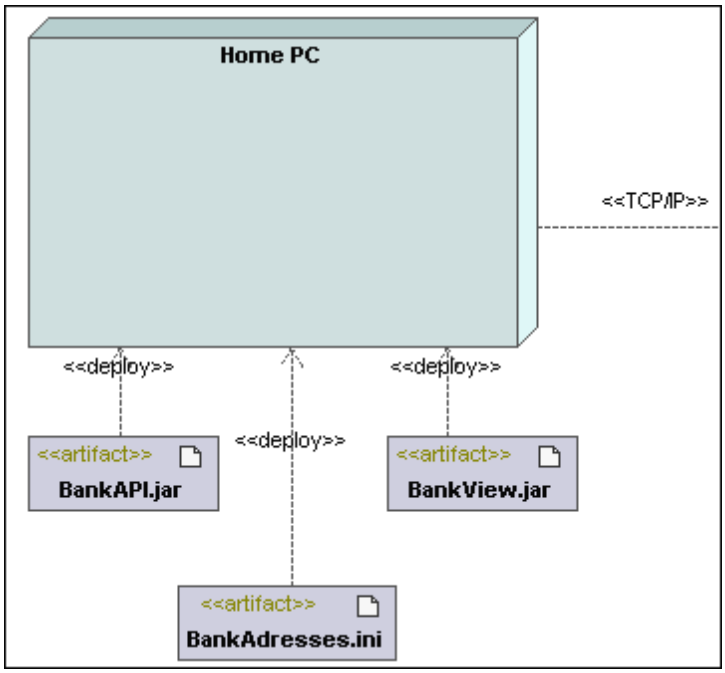
Please note:

Having clicked the dependency arrow (or any named elements), you can also enter text directly through the keyboard, without having to first click into the name field.

Adding artifacts to a node and creating dependencies between them:

Expand the Deployment View package, in the Model Tree, to see its contents:

1. Click each of the **BankAddresses.ini**, **BankAPI.jar** and **BankView.jar** artifacts individually, and place them on the diagram background (Deployment dependencies are displayed for each artifact).



2. Click the **BankView.jar** artifact and drag it onto the **Home PC** node.
   The node is highlighted when the drop action will be successful.
3. Use the same method to drag the other artifacts onto the Home PC node.
   The artifacts are now part of the node and move with it when it is repositioned.

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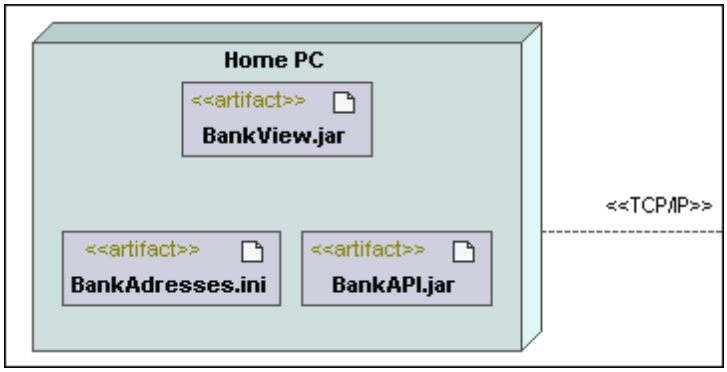
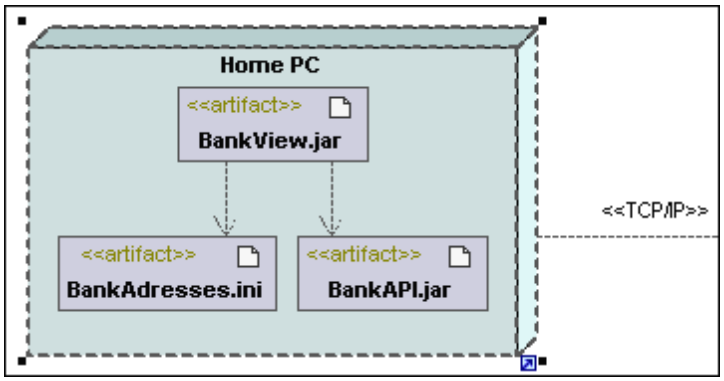


4. Click the Dependency icon in the icon bar, and hold down the **CTRL** key.
5. Drag from the **BankView.jar** artifact to the **BankAddresses.ini** artifact; still holding down the CTRL key.
6. Drag from the **BankView.jar** artifact to the **BankAPI.jar** artifact.



Please note:

Dragging an artifact out of a node onto the diagram background, automatically creates a Deployment dependency.

To delete an artifact from a node and the project:

- Click the artifact you want to delete and press the **Del** keyboard key.

  The artifact and any dependencies are deleted from the **node** as well as the **project**.

To remove an artifact from a node and its diagram:

1. Use drag and drop to place the artifact onto the diagram background.
2. Hold down the **CTRL** key and press **Del**.

   The artifact and any dependencies are deleted from the current **diagram** and not from the project.

To create operations / properties, or nesting artifacts:

1. **Right** click the artifact in the **Model Tree**.
2. Select the appropriate action from the **context** menu, e.g. **New Element** | **Operation**, | **Property**, or | **Artifact**.
   The new element will appear below the selected artifact in the Model Tree.

3.7 Round-trip engineering (model - code - model)

Altova web site: UML code generation and UML Round-trip engineering

The aim of this tutorial section is to:

- Perform a project syntax check
- Generate project code
- Add a new method external code i.e. to the SavingsAccount class
- Synchronize the UModel model with the new code

Packages and Code / model synchronization:
Code can be merged/synchronized at different levels:

- Project, Root package level (menu item)
- Package level (multiple package selection / generation is possible)
- Class level (multiple class selection / generation is possible)
- Component level

The BankView realization diagram depicts how the BankView component is realized by its six constituent classes. This is the component that is produced when the forward-engineering section of the tutorial is complete.

To be able to produce code:

- The component must be **realized** by one or more classes.
- The component must have a **physical location**, i.e. directory, assigned to it. The generated code is then placed in this directory.
- Components must be individually set to be **included** in the code engineering process.
- A Java, C#, or VB namespace root package must be defined.

Please note:

The Java namespace root has been set on the **Design-phase | BankView | com** package in the Model Tree.

Java, C# or VB code can be combined in one project and are automatically handled during the round-trip engineering process. The Bank_MultiLanguage.ump file in the ... **UModelExamples** folder is an example of a project for Java and C# types of code.

To define a code generation target directory:

1. Double click the **Overview** icon under the **Design-phase** package to switch into the component overview.
2. Click the **BankView** component, in the diagram, and note the current settings in the Properties tab.
3. Click the browse button ..., to the right of the directory field.
4. Enter/select the target directory in the dialog box (the supplied example is defined as **InstallationDir\UModelExamples\Tutorial\umlcode\bankview**), or click the "Make New Folder" button to create a new folder.
   The path now appears in the directory field.

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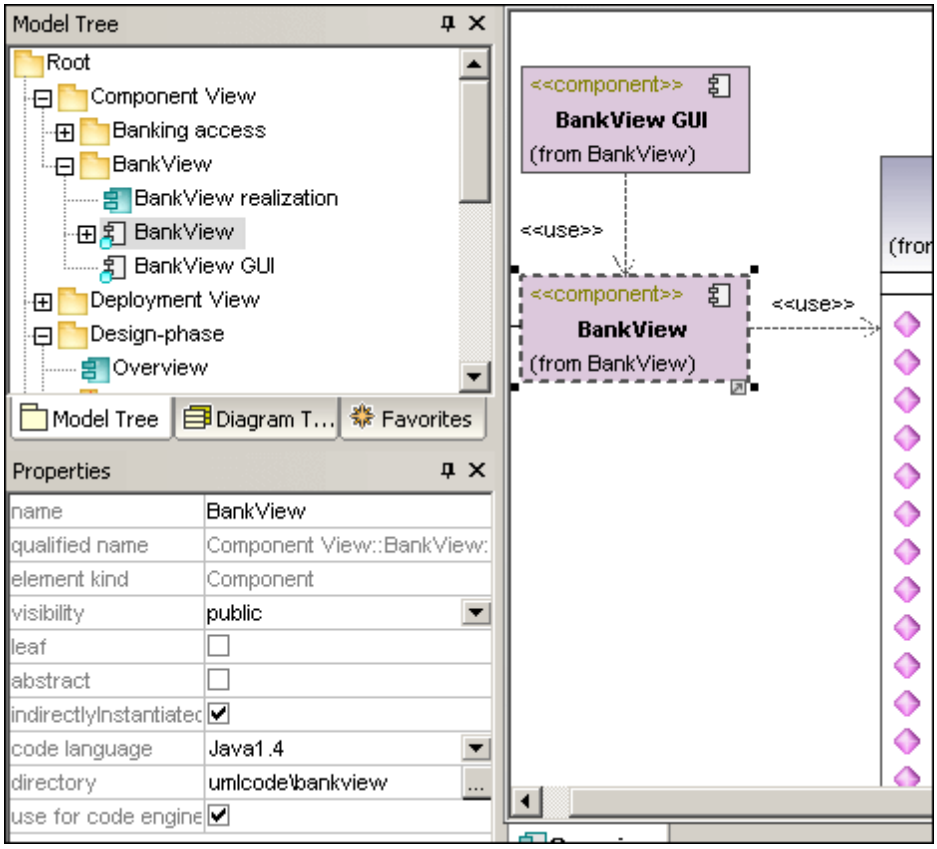


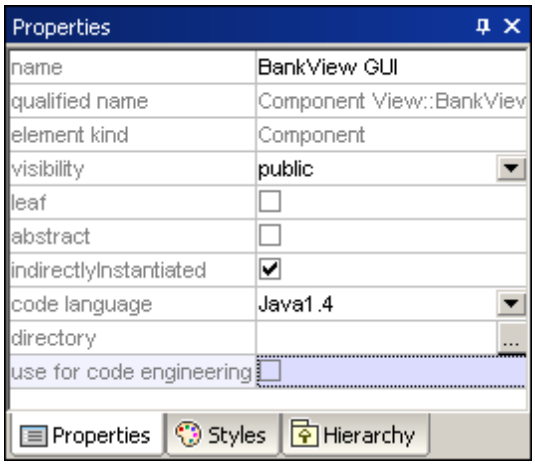
Please note:

UModel Java usually follows the convention of creating code in directories according to their namespace e.g. ...\code\namespace1\C1.java.

If you want to use this directory naming convention for C# and VB .NET, select the menu option **Tools | Options | Code Engineering** and select the relevant option in the "**Use namespace for code file path**" group.

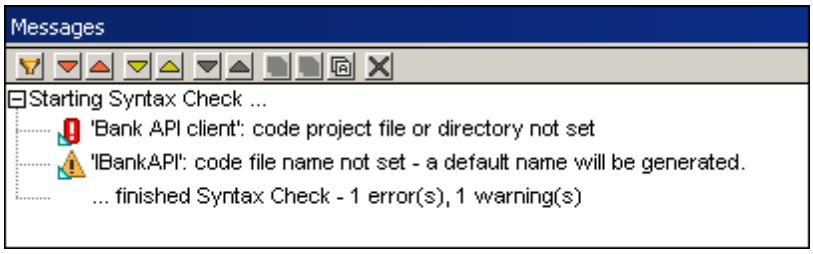
To include/exclude components from code generation:

1. Click the **BankView GUI** component.
2. **Uncheck** the "use for code engineering" check box (if not already unchecked).

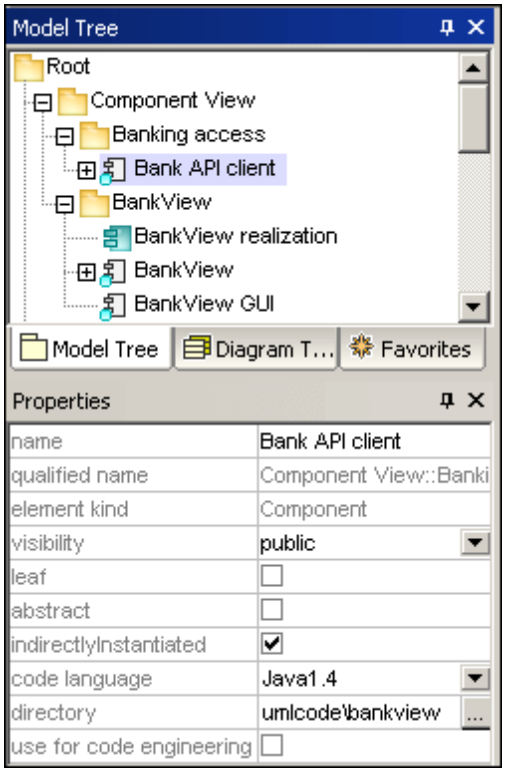


Checking project syntax prior to code generation:

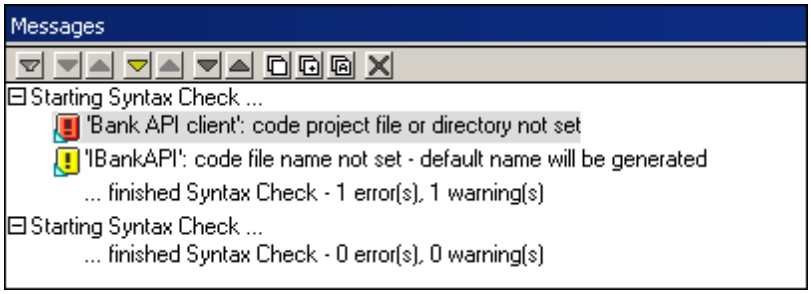
1. Select the menu option **Project | Check project syntax**.
2. A syntax check is performed, and messages appear in the Messages window, "Bank API-client: **code project file or directory not set**" - "IBankAPI: code file name not set".


Messages
Starting Syntax Check ...
'Bank API client': code project file or directory not set
'IBankAPI': code file name not set - a default name will be generated.
... finished Syntax Check - 1 error(s), 1 warning(s)

3. Click the first message in the messages window.
4. The Bank API client package is highlighted in the Model Tree view, with its properties visible in the Properties tab.
5. **Uncheck** the "use for code engineering" check box for the Bank API client component.



6. Check the project syntax again using **Project | Check project syntax**.


Messages
Starting Syntax Check ...
'Bank API client': code project file or directory not set
'IBankAPI': code file name not set - default name will be generated
... finished Syntax Check - 1 error(s), 1 warning(s)
Starting Syntax Check ...
... finished Syntax Check - 0 error(s), 0 warning(s)

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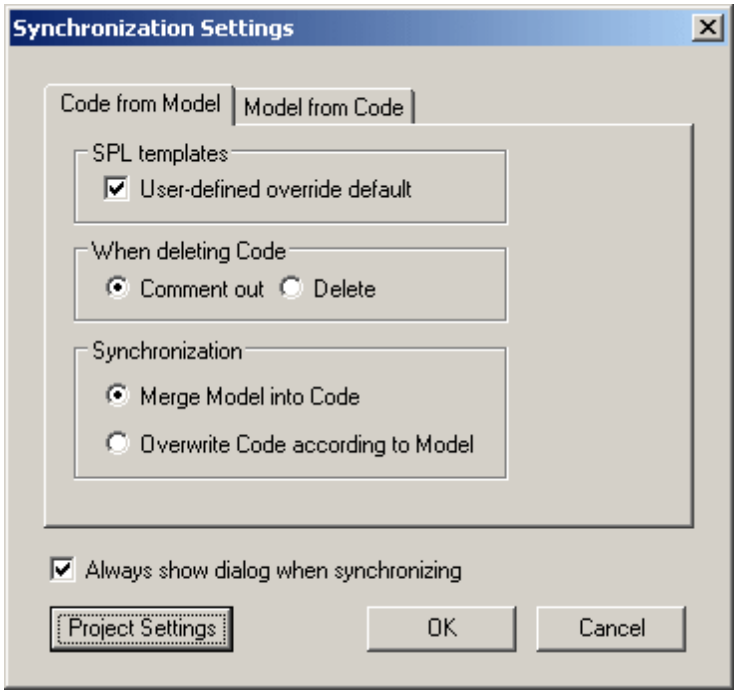
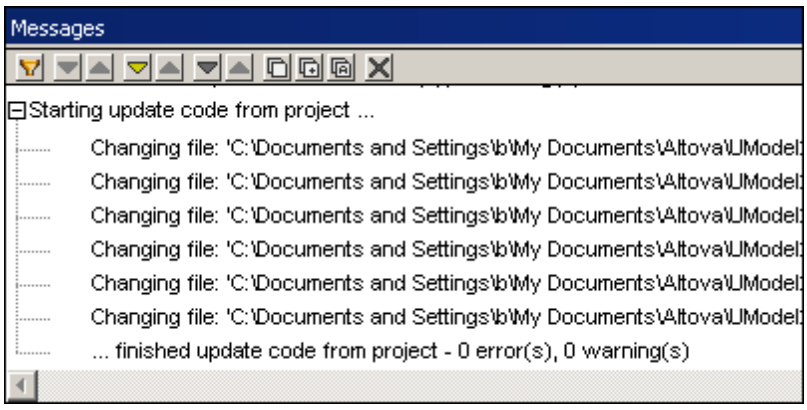
No errors are reported this time around. We can now generate program code for this project. Please see Check Project syntax for more information.

To generate project code:

1. Click the **BankView** package to select it.
2. Select the menu option **Project | Merge Program Code from UModel project**.
3. Select your synchronization options from the dialog box, and press OK to proceed (no changes needed for the tutorial; see "Merge Program Code from UModel project" for more information).



The message pane displays the outcome of the code generation process.


Messages
Starting update code from project ...
Changing file: 'C:\Documents and Settings\b\My Documents\Altova\UModel
Changing file: 'C:\Documents and Settings\b\My Documents\Altova\UModel
Changing file: 'C:\Documents and Settings\b\My Documents\Altova\UModel
Changing file: 'C:\Documents and Settings\b\My Documents\Altova\UModel
Changing file: 'C:\Documents and Settings\b\My Documents\Altova\UModel
Changing file: 'C:\Documents and Settings\b\My Documents\Altova\UModel
... finished update code from project - 0 error(s), 0 warning(s)

4. Navigate to the target directory.
   Six **.Java** files have been created for the project.

Synchronizing the UModel model having updated Java code externally:

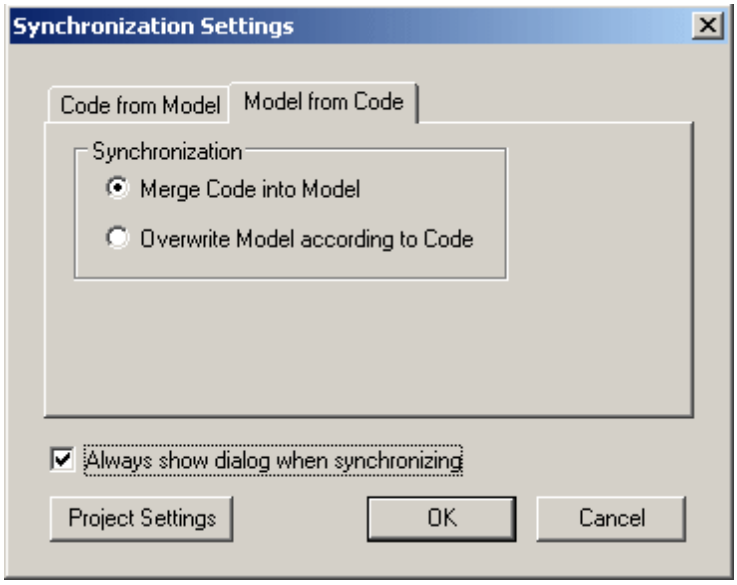
1. Open the **SavingsAccount.java** file in the text editor of your choice, XMLSpy for example.

2. Add the new **method** to the generated code "**public float getInterestRate() {}**", and save the file.

```
1
2   public class SavingsAccount extends Account
3   {
4
5       protected float interestRate;
6
7       public SavingsAccount()
8       {
9       }
10
11      public float getMinimumBalance()
12      {
13      }
14
15      public float getInterestRate()
16      {
17      }
18
19      public boolean collectAccountInfo(IBankAPI bankAPI)
20      {
21      }
22  }
23
```

3. Switch to UModel and right click the **SavingsAccount** class under the BankView package.
4. Select the option **Code Engineering | Merge UModel Class from Program Code**.

   This opens the Synchronization Settings dialog box with the "Model from Code" tab being active. No changes are needed for the tutorial; see "Merge UModel project from code" for more information)



5. Click OK to merge the model from the code.

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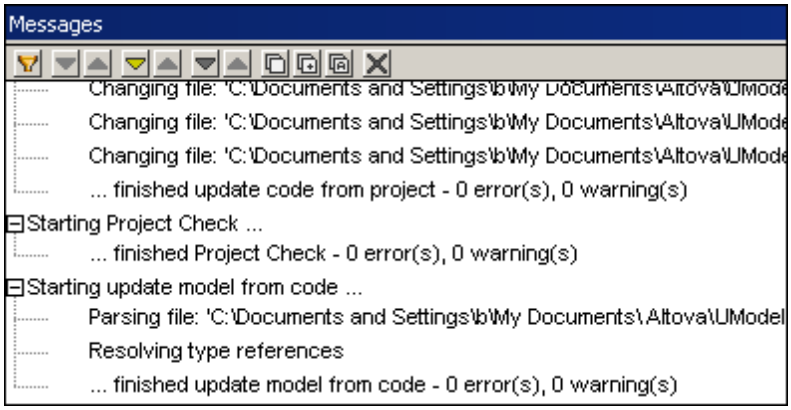
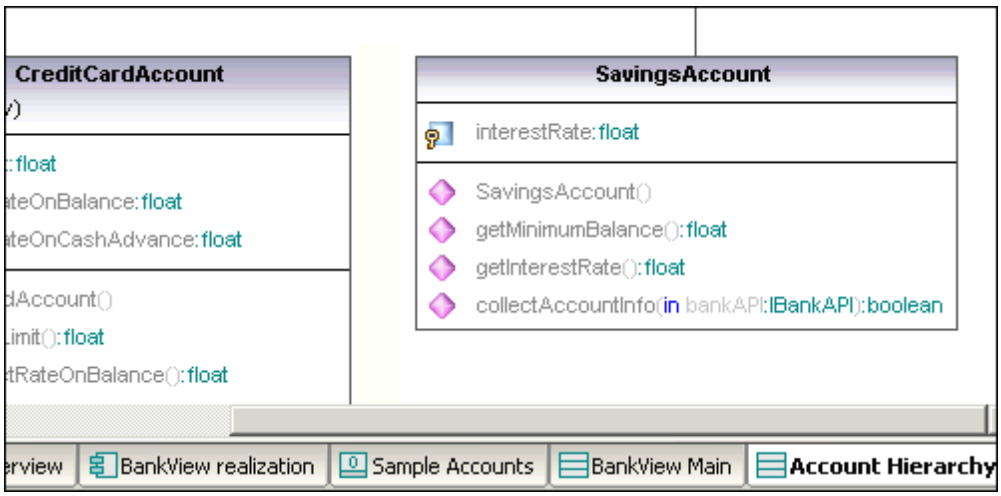

Messages
Changing file: 'C:\Documents and Settings\b\My Documents\Altova\UMode
Changing file: 'C:\Documents and Settings\b\My Documents\Altova\UMode
Changing file: 'C:\Documents and Settings\b\My Documents\Altova\UMode
... finished update code from project - 0 error(s), 0 warning(s)
Starting Project Check ...
... finished Project Check - 0 error(s), 0 warning(s)
Starting update model from code ...
Parsing file: 'C:\Documents and Settings\b\My Documents\Altova\UModel
Resolving type references
... finished update model from code - 0 error(s), 0 warning(s)

6. Click the **Account Hierarchy** tab to see the outcome of the merge process.



The new method added to the code, (getInterestRate...) generates a new **operation** in the SavingsAccount **class** of UModel.

3.8 Round-trip engineering (code - model - code)

Altova web site: Reverse engineering - Java, C#, VB .NET code

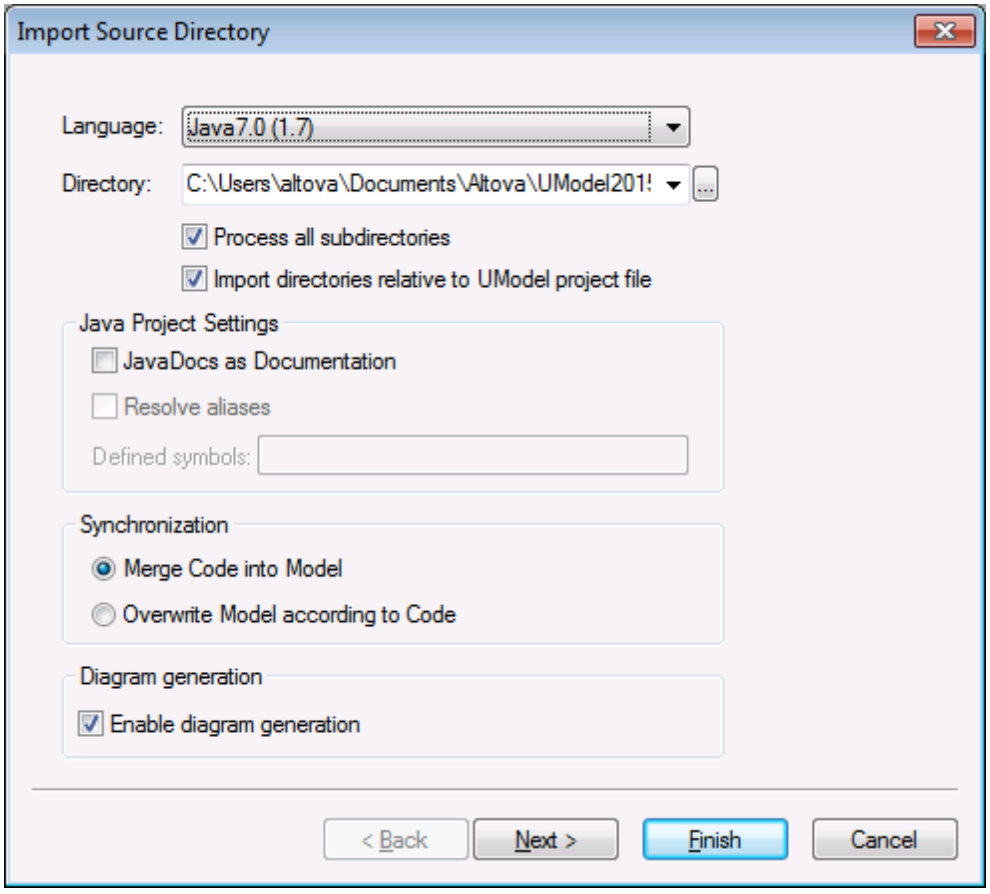
The aim of this tutorial section is to:

- Import a directory containing Java code generated by XMLSpy
- Add a new class to the project in UModel
- Merge to the program code from a UModel package

The files used in this example are available as the **OrgChart.zip** file under **...\UModelExamples** folder of your installation. Please unzip the **OrgChart.zip** file into the **...UModelExamples** folder before you start this section. This creates the **OrgChart** directory which will then be used to import the existing code.

Importing existing code from a directory

1. On the **File** menu, click **New**.
2. On the **Project** menu, click **Import Source Directory**.
3. Select the C#, Java, or VB version of the source code.
4. Click the Browse button ... and select the **OrgChart** directory in the **...\UModelExamples** folder.



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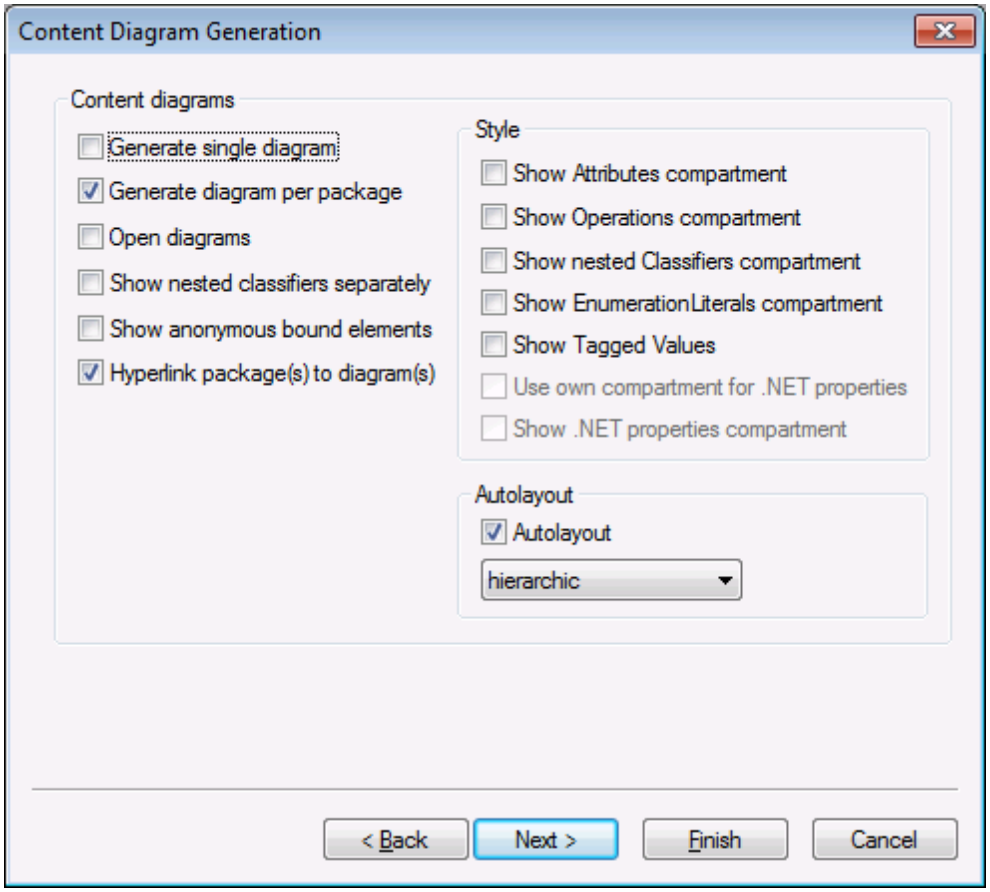
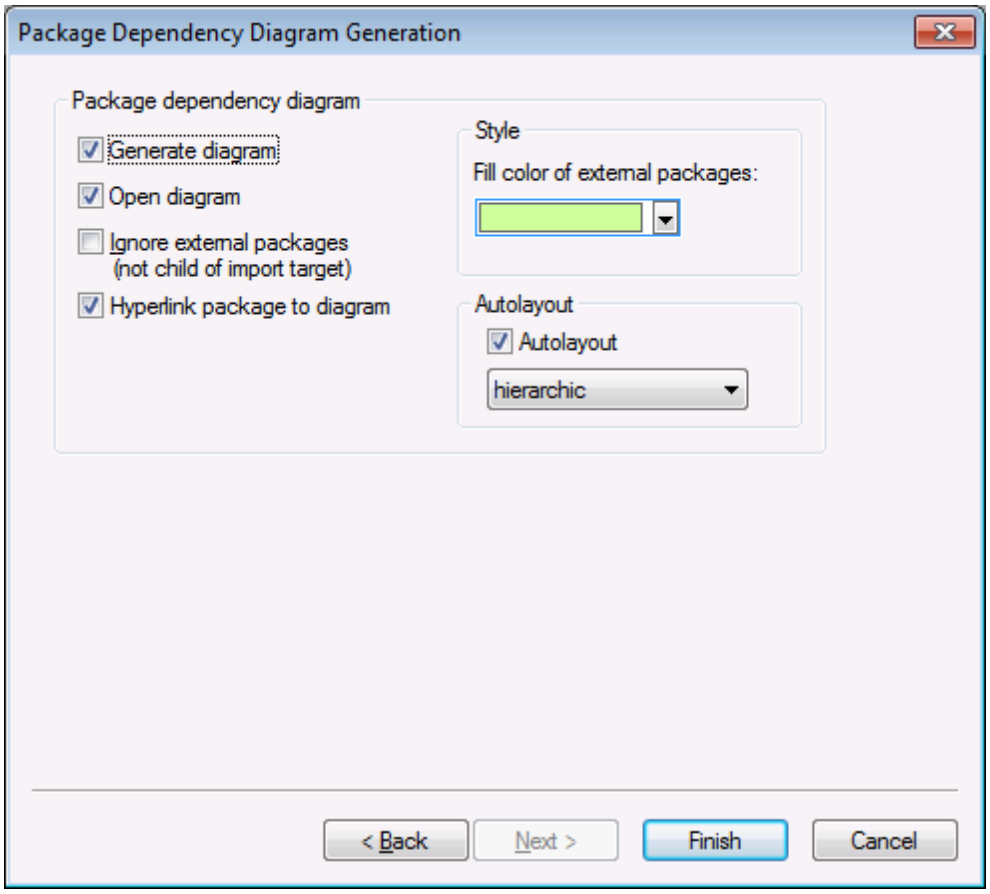
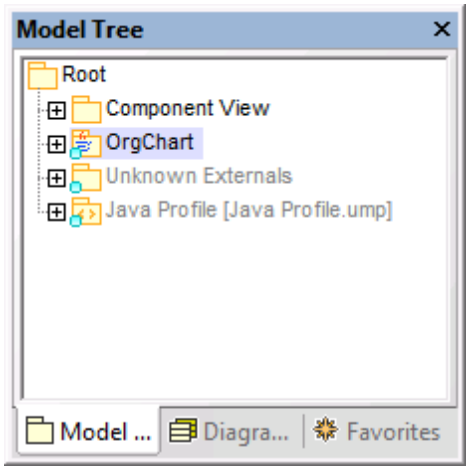
5. To instruct UModel to generate Class Diagrams and Package Diagrams from the source code, select the "**Enable diagram generation**" check box, and click Next.
6. When prompted, select the **Generate single diagram** and/or **Generate diagram per package** options. The diagram styling options can be changed later if necessary.



7. Click **Next** to continue. This dialog box allows you to define the package dependency generation settings.



8. Click **Finish**. When prompted, save the new model to a directory on your system. The data is parsed, and a new package called "**OrgChart**" is created.



9. Expand the new package and keep expanding the sub packages until you get to the **OrgChart** package (**com | OrgChart**). Double-click the "**Content of OrgChart"** diagram icon:

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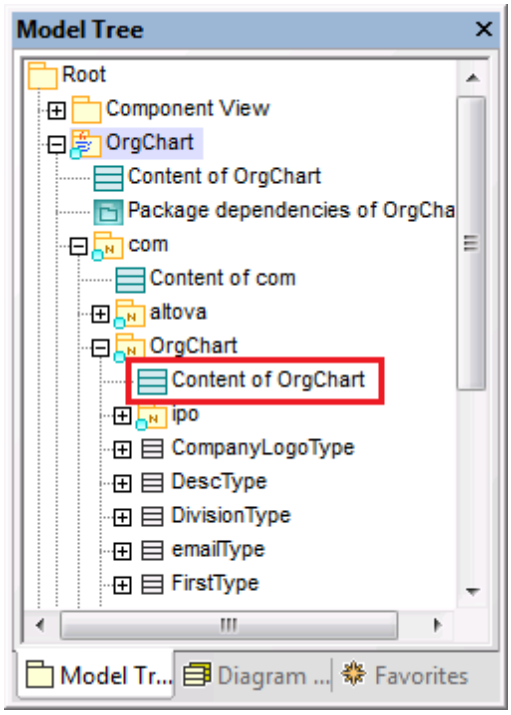
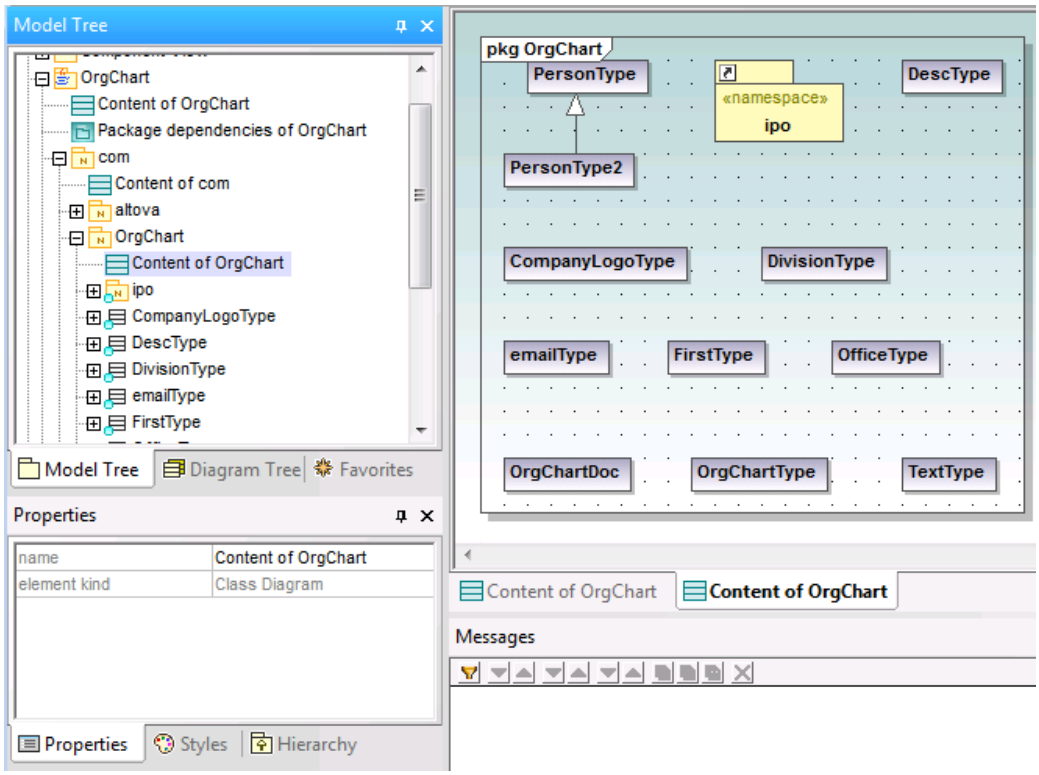
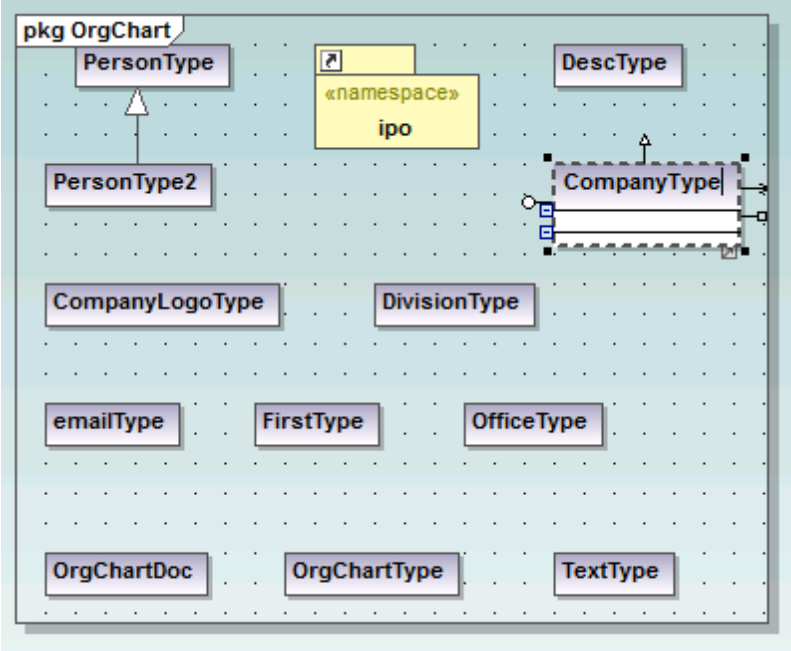


The collapsed classes that make up OrgChart are displayed in the main pane.

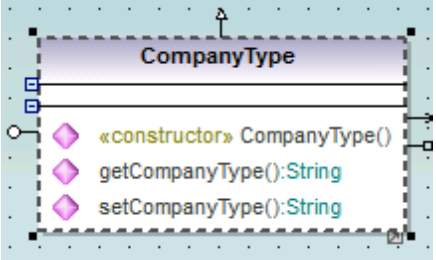


Adding a new class to the OrgChart diagram

1. Right-click inside the main pane, and then select **New | Class** from the context menu.
2. Click the header of the new class, and enter **CompanyType** as the name of the new class.



3. Add new operations to the class using the **F8** shortcut key. For the purpose of this example, add the following operations: **CompanyType()**, **getCompanyType():String**, **setCompanyType():String.**



Making the new class available for code generation

1. While the **CompanyType** class is active, click into the "code file name" field and enter the Java file name of the new class **CompanyType.java**.

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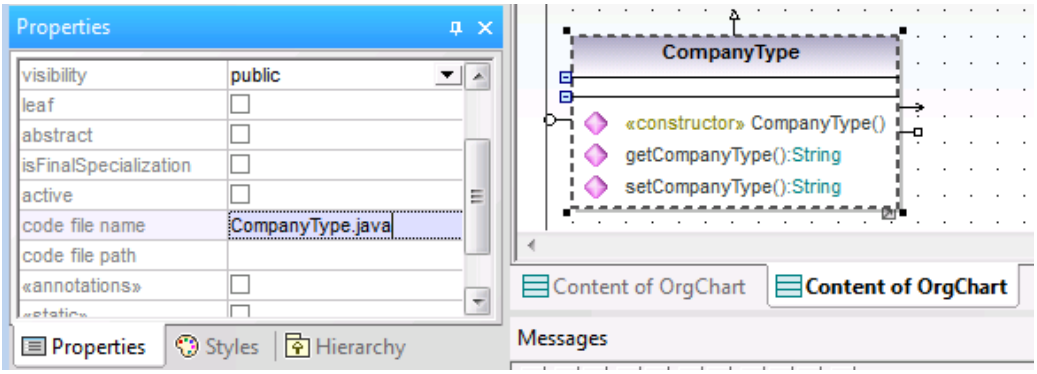
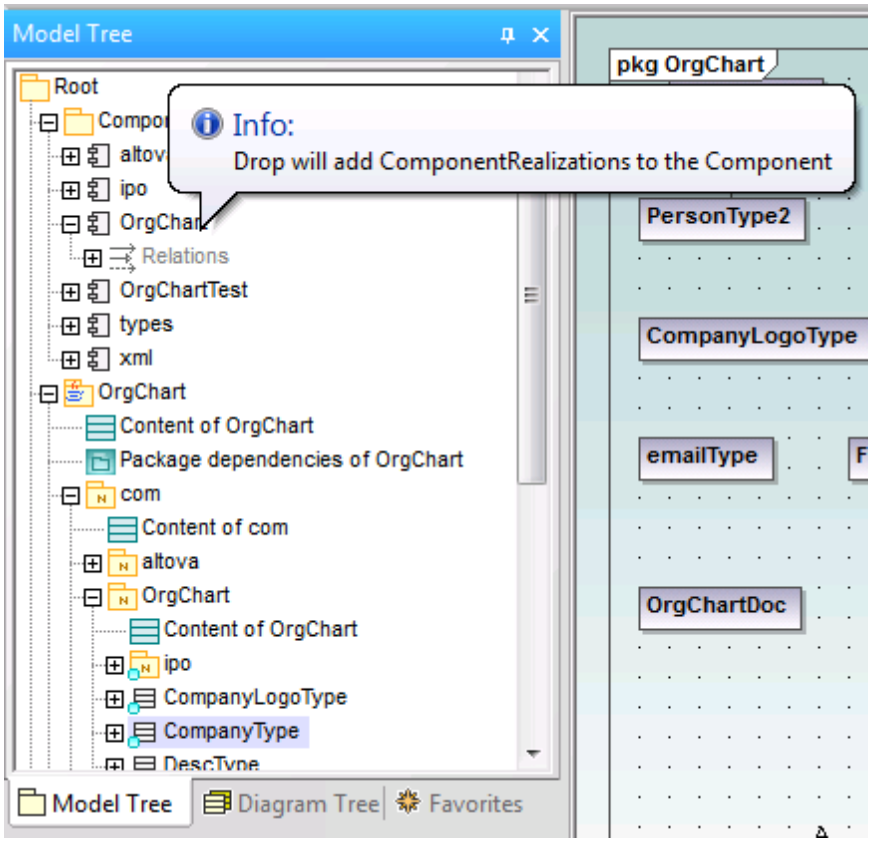


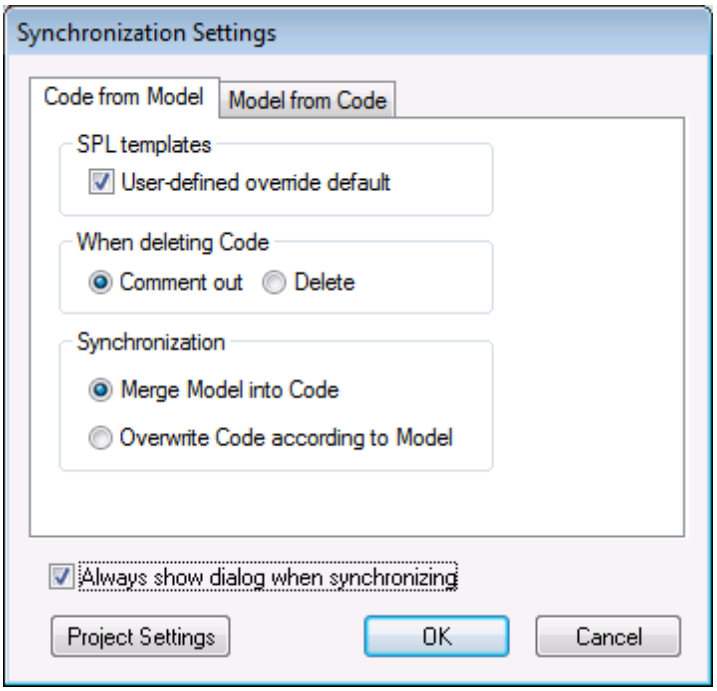
2. Click the new CompanyType **class** in the Model Tree, drag upwards and drop onto the **OrgChart** component below the Component View package. A notification appears when the mouse pointer is over a component.



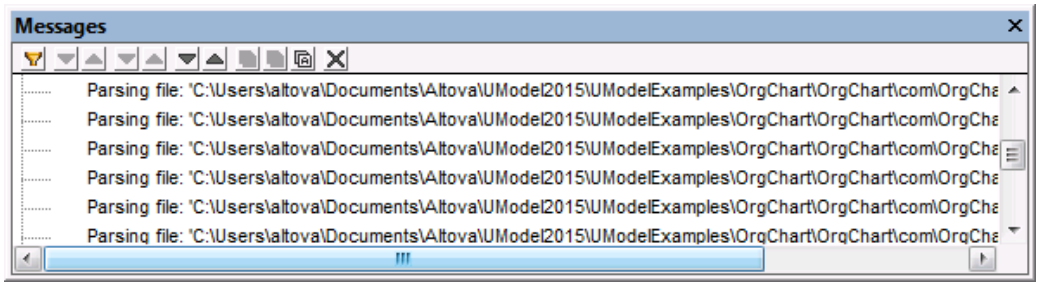
This method creates a Realization between a class and a component, so that you do not have to use component or deployment diagrams. Expand the **Relations** item below **OrgChart** to see the newly created Realization.

Merging program code from a package

1. Right-click the **OrgChart** package, select **Code Engineering | Merge Program code from UModel Component**, and then press Enter to confirm.



The messages window displays the syntax checks being performed and status of the synchronization process.



When the process completes, the new **CompanyType.java** class has been added to the folder **...\OrgChart\com\OrgChart\.**

All method bodies and changes to the code will either be commented out or deleted

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depending on the setting in the "When deleting code" group, in the Synchronization settings dialog box.

You have learned how to create a modeling project using the forward engineering process, and also completed a full round-trip code engineering cycle with UModel. The rest of this document describes how best to achieve modeling results with UModel.

Chapter 4

UModel User Interface

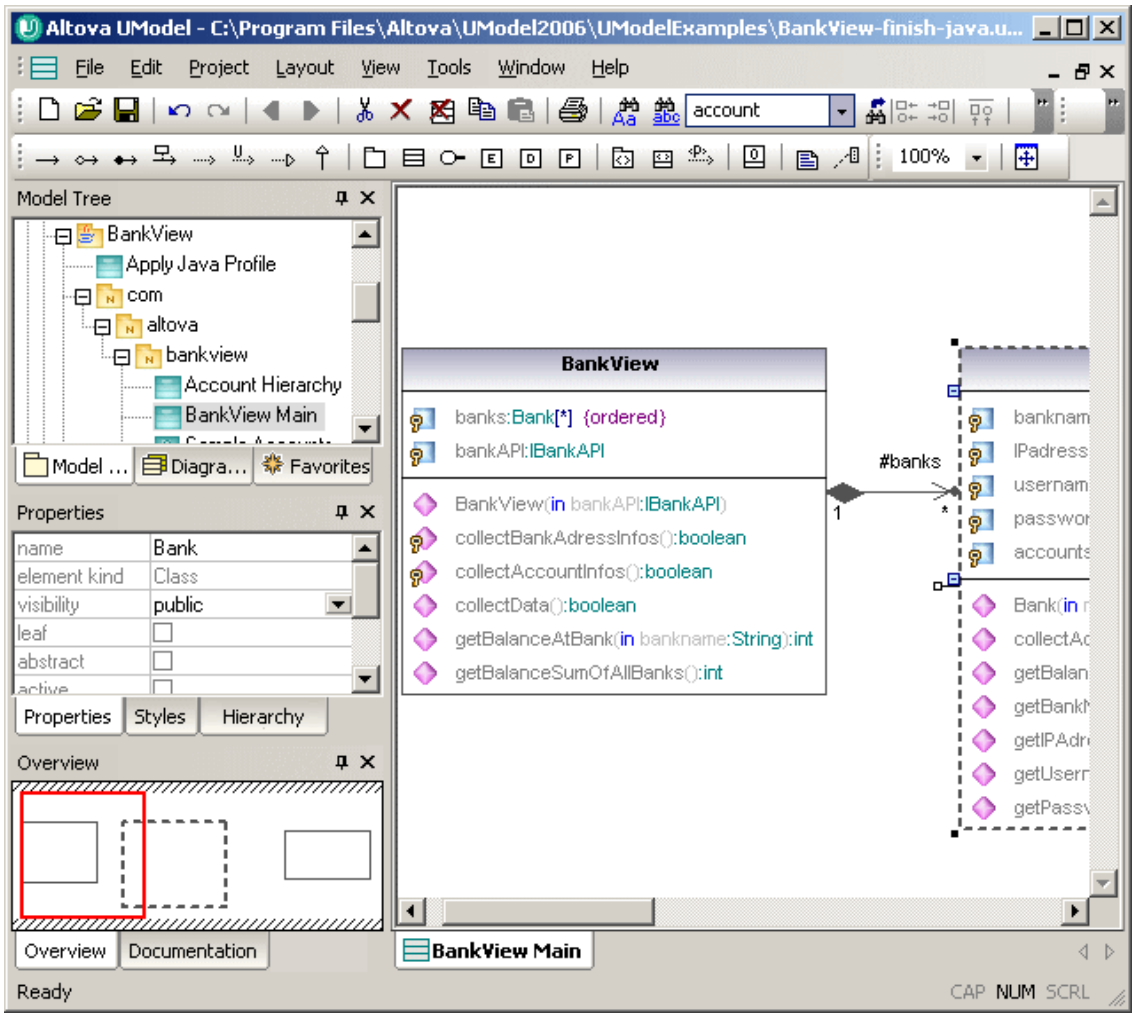
4 UModel User Interface

UModel consists of series of panes on the left and a larger diagram tab at right. The panes at left allow you to view and navigate your UModel project from differing viewpoints, and edit data directly.

The panes are Model Tree, Properties, and Overview. The working/viewing area at right is the UModel Diagram tab which currently shows the Class Diagram of the BankView Main package.

Please note:

All panes, as well as diagram tabs, can be searched using the **Find** combo box in the Main toolbar, which contains the text "**account**" in the screenshot below, or by pressing CTRL+F.



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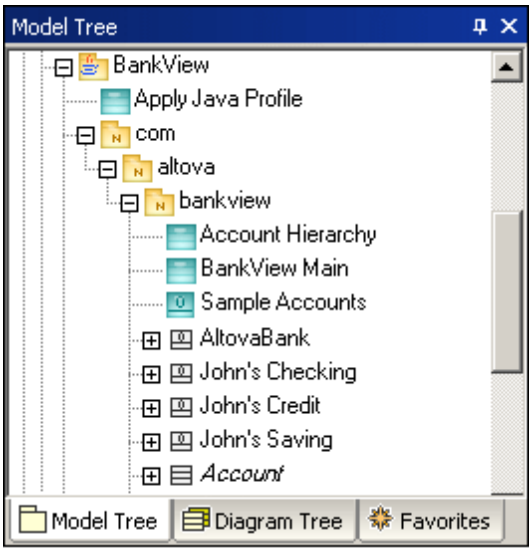
4.1 Model Tree

Model Tree tab

The Model Tree tab allows you to manipulate model items directly in the Model Tree, as well as navigate/view specific items in the Design tab. Right clicking an item opens the context menu, from which specific commands can be selected. The contents of the context menu depend on the item that you select.

Model elements in the Model Tree pane can be directly manipulated:

- Added / inserted
- Copied or moved
- Deleted
- Renamed
- Sorted according to several criteria
- Constrained



In the Model Tree tab, each folder symbol is a UML package!

Adding a new package (or any other modeling element):

1. Right click the **folder** that you want the new package/element to appear under.
2. Select **New | Package** (or respective model Element).

Copying or moving model elements:

1. Use the standard windows Cut, Copy or Paste commands or,
2. Drag model elements to different packages. Dragging an elements moves it. Holding down CTRL a and dragging an element creates a copy.

   When dragging elements a message might appear stating that select "No sort" needs to be activated to allow you to complete the action. Please see "Cut, copy and paste in UModel Diagrams" for more information.

Sorting elements in the Model Tree (activating no sort):

1. Right click the empty background of the Model Tree tab.
2. Select **Sort | No sort**.
   Elements can now be positioned anywhere in the Model Tree.

Please note:

The Sort popup menu also allows you to individually define the sort properties of **Properties** and **Operations**.

Renaming an element:

1. Double click the element **name** and edit it.
   The Root and Component View packages are the only two elements that cannot be renamed.

Deleting an element:

1. Click the element you want to delete (use CTRL+click to mark multiple elements).
2. Press the **Del.** keyboard key.

   The modeling element is deleted from the Model Tree. This means that it is also deleted from the Diagram tab, if present there, as well as from the project. Elements can be deleted from a diagram without deleting them from the project, using CTRL+Del. Please see deleting elements.

To open a diagram in the Diagram tab:

1. Double click the diagram icon of the diagram you want to view in the diagram tab.

Modeling element icon representation in the Model Tree

Package types:

UML Package
Java namespace root package
C# namespace root package
Visual Basic root package
XML Schema root package
Java, C#, or VB code package (package declarations are created when code is generated)

Diagram types:

Activity diagram
Class diagram
Communication diagram
Component diagram
Composite Structure diagram
Deployment diagram
Interaction Overview diagram
Object diagram
Package diagram
Profile diagram
Sequence diagram
State Machine diagram
SysML diagrams (9 diagram types)
Timing diagram
Use Case diagram
XML Schema diagram
Business Process Modeling Notation

Element types:

An element that is currently visible in the active diagram is displayed with a blue dot at its base. In this case a class element.

Class Instance/Object
Class instance slot

Class
Property
Operation
Parameter

Actor (visible in active use case diagram)
Use Case
Component
Node
Artifact
Interface

Relations (/package)
Constraints

Opening / expanding packages in the Model Tree view:
There are two methods available to open packages in the tree view; one opens all packages and sub packages, the other opens the current package.

Click the package you want to open and:

- Press the ***** key to open the current package and all sub packages
- Press the **+** key to open the current package.

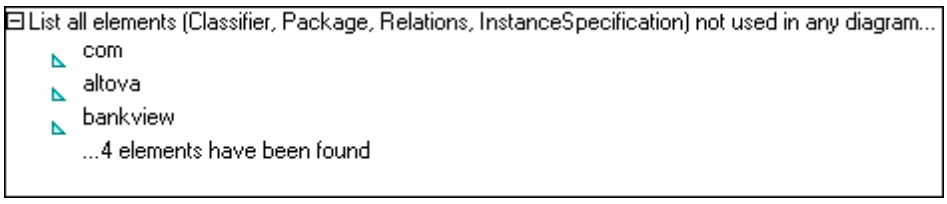
To **collapse** the packages, press the **-** keyboard key. To collapse all packages click the Root package and press **-**.
Note that you can use the standard keyboard keys, or the numeric keypad keys to achieve this.

To find modeling elements in Diagram tab(s):
While navigating the elements in the Model Tree, you might want to see where, or if, the element is actually present in a model diagram. There are two methods to find elements:

1. Right click the element you want to see in the Model Tree tab, and select:
   - Show element in active diagram - to find it in the same type of diagram tab
   - Show element in all diagrams - if currently active diagram differs from selected model element.

To generate a list of elements not used in any diagram:

1. Right click the package you would like to inspect.
2. Select the menu option "List elements not used in any diagram.
   A list of unused element appears in the Messages pane. The list in parenthesis, displays the specific elements which have been selected to appear in the unused list, please see the **View** tab in Reference section under, **Tools | Options** for more information.


List all elements (Classifier, Package, Relations, InstanceSpecification) not used in any diagram...
com
altova
bankview
...4 elements have been found

To **locate** the missing elements in the Model Tree:

- Click the element name in the Messages pane.

Please note:
The unused elements are displayed for the **current** package and its sub packages.

Packages in the Model Tree tab:

Only the Root and Component packages are visible on startup, i.e. when no project is currently loaded.

- Packages can be **created**, or deleted at any position in the Model Tree
- Packages are the containers for all other UML modeling elements, use case diagrams etc.
- Packages/contents can be **moved**/copied to other packages in the Model Tree (as well as into valid model diagrams in the diagram tab)
- Packages and their contents can be **sorted** according to several criteria
- Packages can be placed within other packages
- Packages can be used as the **source**, or **target** elements, when generating or synchronizing code

Generating/merging code:

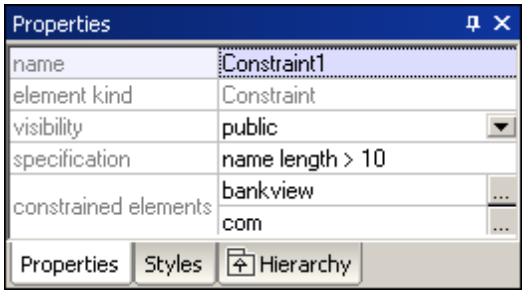
UModel allows you to generate, or merge program code directly from the Model Tree, please see: Synchronizing Model and source code for more information.

Constraining UML elements:

Constraints can be defined for most model elements in UModel. Please note that they are not checked by the syntax checker, as constraints are not part of the Java code generation process.

To constrain an element (Model Tree):

1. Right click the element you want to constrain, and select **New | Constraint**.
2. Enter the name of constraint and press Enter.
3. Click in the "specification" field of the Properties tab, and enter the constraint e.g. name length > 10.



To constrain an element in UML diagrams:

1. Double click the specific element to be able to edit it.
2. Add the constraint between curly braces e.g. interestRate:float **#{interestRate >=0}**.

To assign constraints to multiple modeling elements:

1. Right click the "constrained elements" field in the Properties tab.
2. Select "Add element to constrained elements".
   This opens the "Select Elements to be Constrained" dialog box.

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3. Select the specific element you want to assign the current constraint to.

   The "constrained element" field contains the names of the modeling elements it has been assigned to. The image above, shows that Constraint1 has been assigned to the **bankview** and **com** packages.

4.2 Diagram Tree

Diagram Tree tab
This tab displays the currently available UModel diagrams in two ways:

- Grouped by diagram type, sorted alphabetically
- As an alphabetical list of all project diagrams

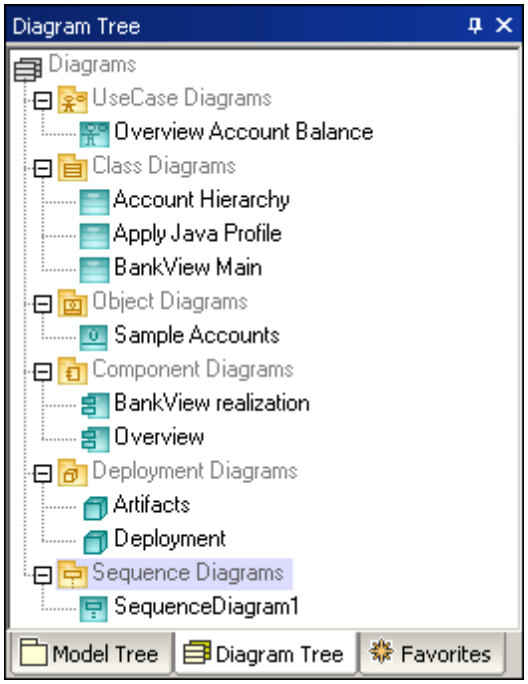
Please note:
Diagrams can be added to, or deleted from, the Diagram Tree tab by right clicking and selecting the requisite command.

To open a diagram in the Diagram tab:

- Double click the diagram you want to view in the diagram tab.

To view all Diagrams within their respective model groups:

- Right click in the pane, and activate the "Group diagram by diagram type" option.



Diagrams are grouped alphabetically within their group.

To view all Diagram types in list form (alphabetically):

- Right click in the pane, and deactivate the "Group diagram by diagram type" option.

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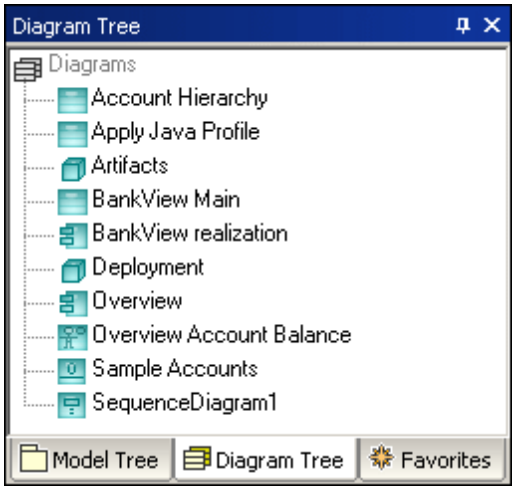


All Diagrams are shown in an alphabetically sorted list.

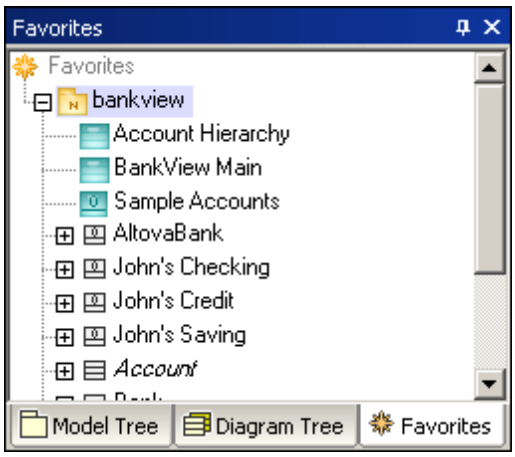
4.3 Favorites

Favorites tab
Use this tab as a user-defined repository, or library, for all types of **named** UML elements i.e. classes, objects, associations etc. but not ProfileApplication or Generalization dependencies. This allows you to create your personal pick-list of modeling elements for quick access.

The contents of the Favorites tab are automatically saved with each project file. Select the menu option **Tools | Options, File** tab and click the "Load and save with project file" check box to change this setting.

To add an existing modeling element to the Favorites tab:

1. Right click an element in the Model Tree tab, or in the diagram working area.
2. Select the menu item "Add to Favorites".
3. Click the Favorites tab to see the element.



The element appears in the Favorites tab is a view of an existing element, i.e. it is not a copy or clone!

To add a NEW element to the Favorites tab:

1. Right click a previously added package, to which you want to add the element.
2. Select **New | "modeling element"** from the context menu, where "modeling element" is a class, component, or any other modeling element available in the context menu.
   New elements are added to the same element/package in the project, and are therefore also visible in the Model Tree tab.

To REMOVE an element from the Favorites tab:

1. Right click the same element/package that you added to Favorites.
2. Select **Remove from Favorites**.

Please note:
You can add and remove elements added to the Favorites tab, from the Favorites tab, as well as the Model Tree tab.

Deleting elements from the Favorites tab:

1. Right click the element you want to delete, and press the Del key.
   A message box appears, informing you that the element will be deleted from the project.
2. Click OK if you want to delete it from the project.
3. Click Cancel to retain it, and use the **Remove method** described above, to delete it from

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the Favorites tab.

4.4 Properties

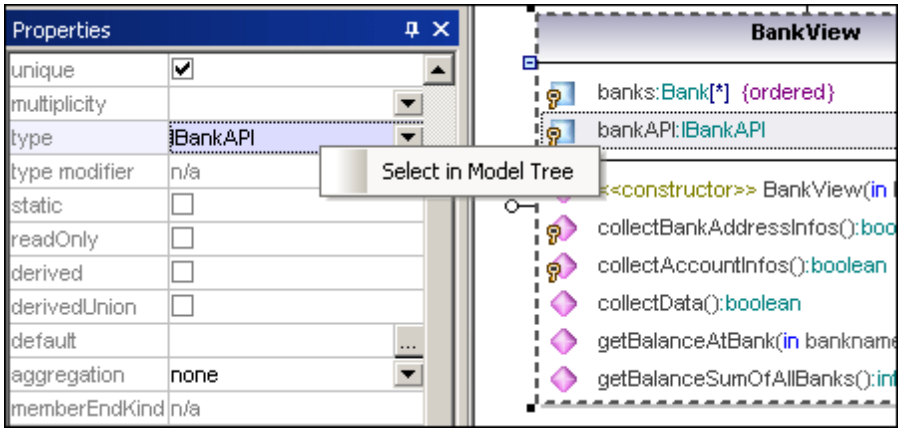
Properties tab
The Properties tab displays the UML properties of the currently active element.

- Clicking **any** model element in any of the supplied views, or tabs, displays its properties.
- Once visible, model properties can be changed, or completed, by entering data, or selecting various options in the tab.
- Selected properties can also be located in the diagram tabs by selecting Show in Active Diagram from the context menu.

Select in Model Tree

Clicking an attribute in a class diagram displays its properties in the Properties tab. To navigate/find it in the Model Tree:

1. Right click the **type** entry of the attribute in the Properties tab.
2. Click the "Select in Model Tree" popup.



The IBankAPI interface is now visible in the Model Tree.

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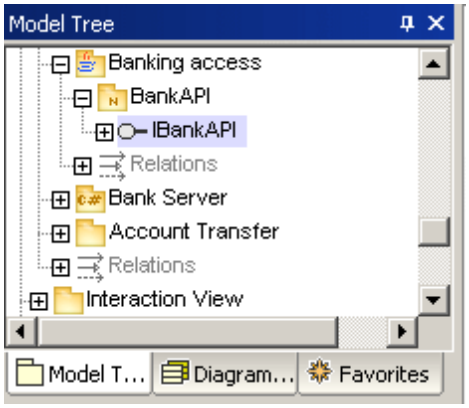
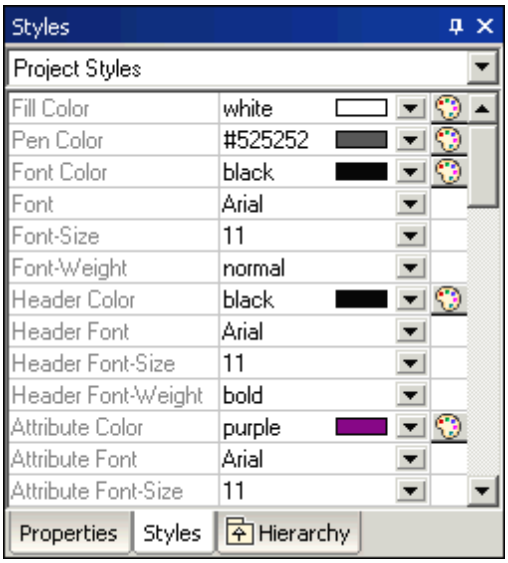

Model Tree
Banking access
BankAPI
IBankAPI
Relations
Bank Server
Account Transfer
Relations
Interaction View
Model T...
Diagram...
Favorites

4.5 Styles

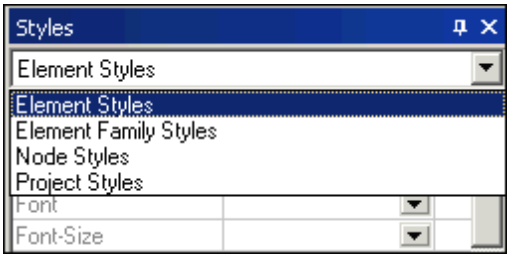
Styles tab
The Styles tab is used to view, or change attributes of diagrams, or elements that are displayed in the diagram view.



These style attributes fall into two general groups:

- Formatting settings; i.e. font size, weight, color etc.
- Display settings/options; show background color, grid, visibility settings etc.

The Styles tab is subdivided into several different categories/sections which can be selected by clicking the "Styles" combo box. The combo box contents depends on the currently selected model element.



Clicking an element in a diagram tab automatically selects the Element Style context, while clicking and element in the Model Tree tab selects the Project Style context.

Style **precedence** is bottom-up, i.e. changes made at the more **specific** level override the more general settings. E.g changes (to an object) made at the Element Style level override the current Element Family and Project Styles settings. However, selecting a different object and changing the Element Family Styles setting, updates all other objects except for the one just changed at the Element Style level.

Please note:
Style changes made to model elements can all be undone!

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Element Styles:
Applies to the currently selected element in the currently active diagram. Multiple selections are possible.

Styles of Elements with this Stereotype:
Applies to the currently selected stereotype class in the diagram it has been defined, please see User-defined stereotype styles.

Element Family Styles:
Applies to all elements of the same type i.e. of the selected Element Family. E.g. you want to have all Component elements colored in aqua. All components in the Component and Deployment diagrams are now in aqua.

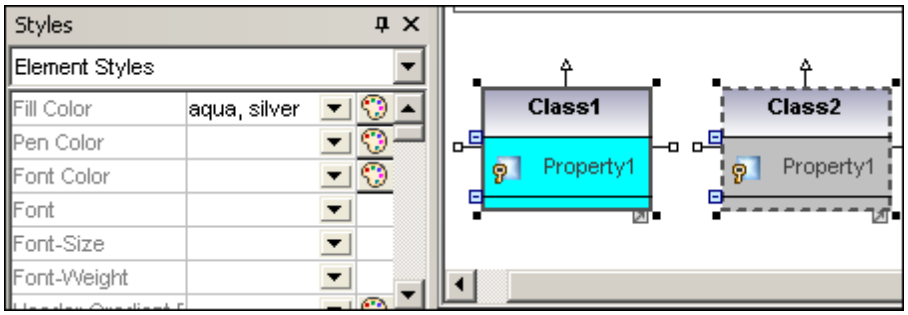
Node / Line Styles:
"Node" applies to all rectangular objects.
"Lines" applies to all connectors: association, dependency, realization lines etc. for the whole project.

Project Styles:
Project Styles apply to the current UModel Project in its entirety (e.g. you want to change the default Arial font to Times New Roman for all text in all diagrams of the project).

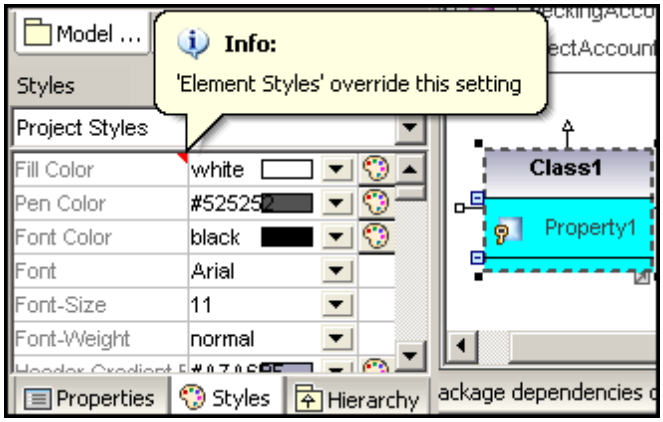
Diagram Styles:
These styles only becomes available when you click/select a diagram background. Changing settings here, only affects the single UML diagram for which the settings are defined in the project.

To change settings for all diagrams of a project:
1. Click in the respective diagram,
2. Select the **Project Styles** entry in the combo box, and scroll to the bottom of the tab.
3. Select one of the **Diag.yyy** options e.g. Diag. Background color.
   This then changes the background color of all diagrams in the current project.

Styles display when multiple elements are selected:
If multiple elements are selected in the diagram pane, then all different style values are displayed in the respective field. In the screenshot below, Class1 and Class2 have been selected.
The fill Color field displays the values for each of the elements, i.e. aqua and silver.



Displaying cascading styles:
If a style is overridden at a more specific level, a small red triangle appears in the respective field in the styles tab.
Placing the mouse pointer over the field displays a popup which indicates the style precedence.



E.g.
The Enumeration, Package and Profile elements all have default fill color settings defined in the Element Family Styles settings. To change the fill colors at the project level, clear the value in the Element Family Styles i.e. select the empty entry in the drop-down list box, select Project styles from the Styles combo box, and change the fill color there.

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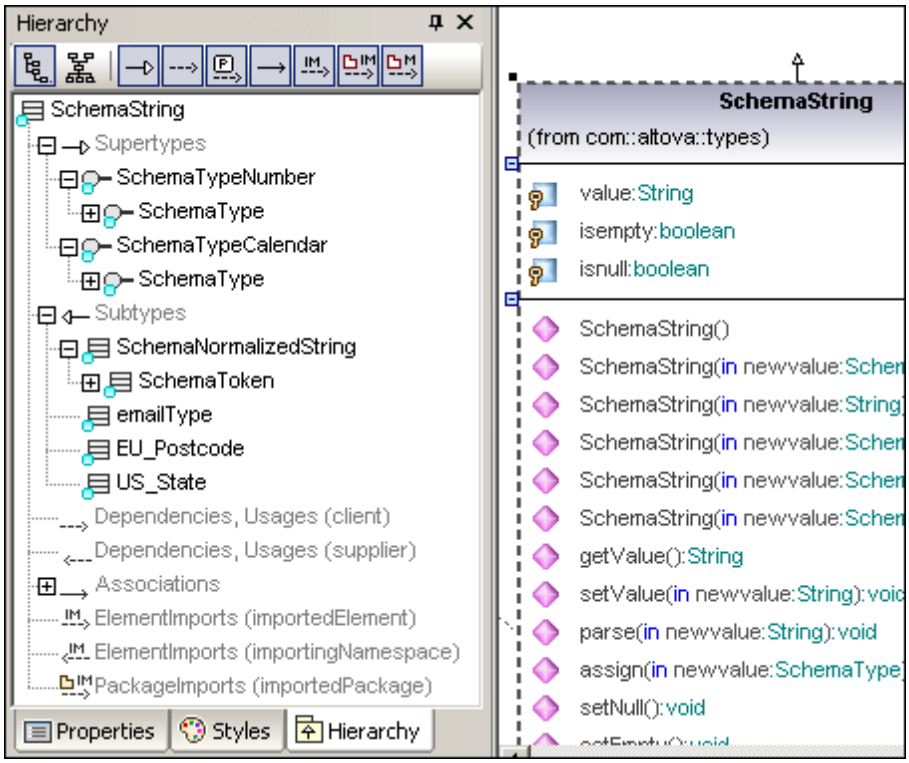
4.6 Hierarchy

Hierarchy tab
The hierarchy tab displays **all relations** of the currently selected modeling item, in two different views. The modeling element can be selected in a modeling diagram, the Model Tree, or in the Favorites tab.

Please note:
General Hierarchy tab settings are set using the menu option **Tools | Options | View**, in the Hierarchy group in the lower section of the dialog box.

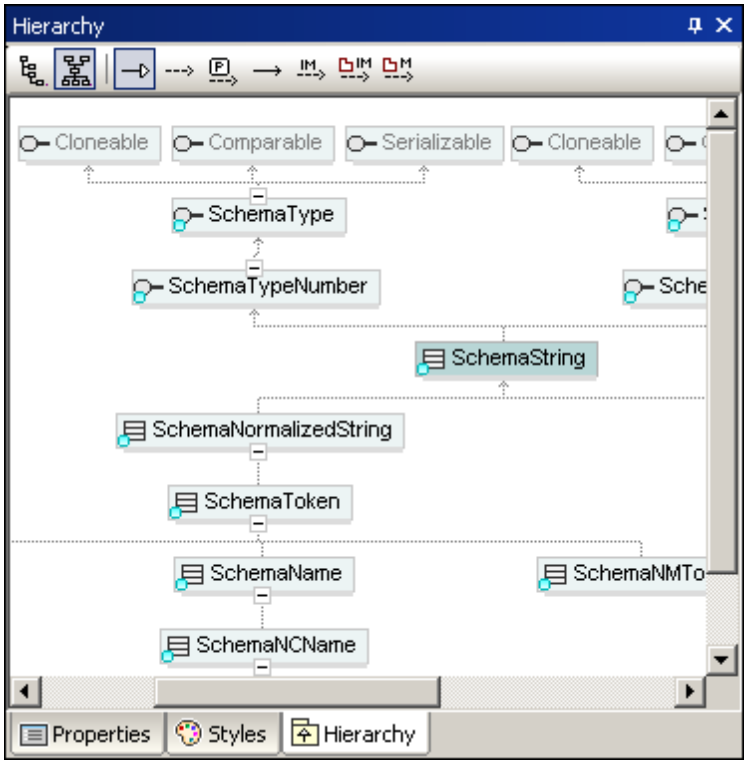
Show Tree view



This view shows **multiple** relations of the currently selected element e.g. SchemaString. Clicking the various icons in the icon bar, allows you to show all types of relations, or narrow them down by clicking/activating the various icons. In the screenshot above, all icons are active and thus all relations are shown in a tree view.

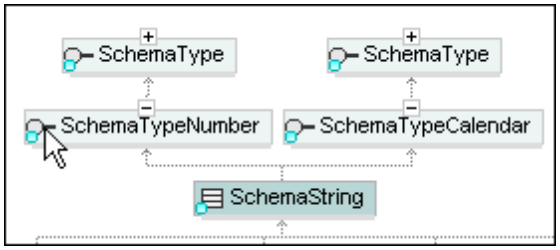
Double clicking one of the element **icons**, in the tab, displays the relations of that element.

Show graph view

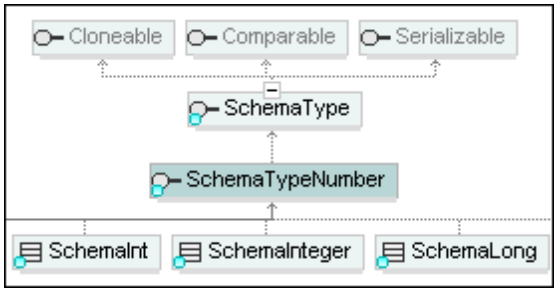


This view shows a **single** set of relations in an hierarchical overview. Only one of the relation icons can be active at any one time. The Show Generalizations icon is currently active.

Double clicking one of the element **icons** in the tab, e.g. SchemaTypeNumber, displays the relations of that element.



The currently selected element is now SchemaTypeNumber.



Creating a new diagram from the contents of the window:

The current contents of the graph view pane can be displayed in a new diagram.

1. Right click in the graph view pane and select **Create diagram as this graph**.

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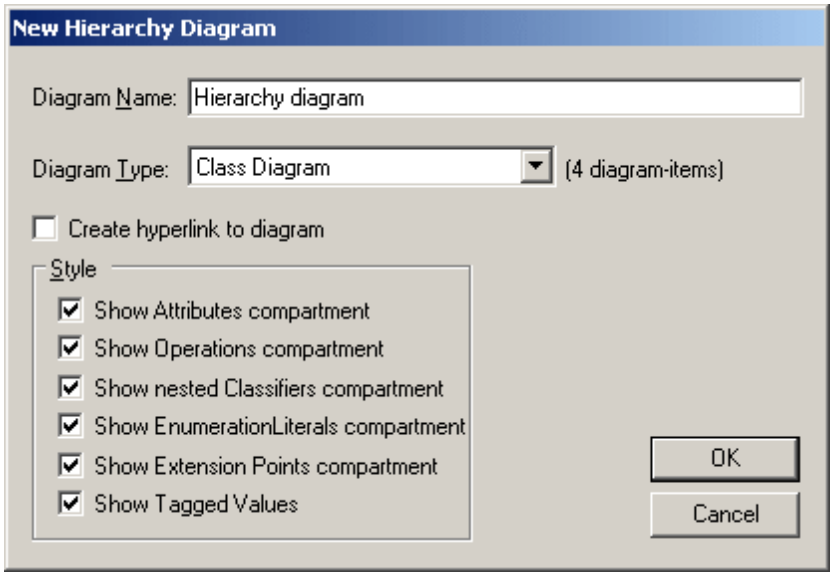
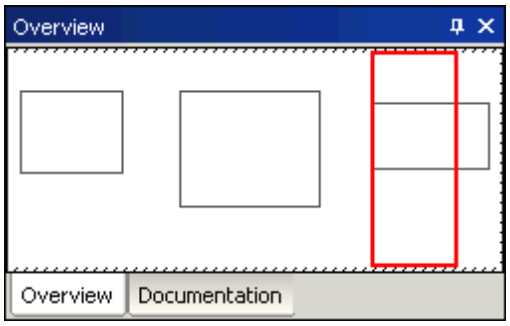


2. Edit the diagram name if necessary, select the style options and click OK.
   A new diagram is created.

4.7 Overview

Overview tab
The Overview tab displays an outline view of the currently active diagram. Clicking and dragging the red rectangle, scrolls the diagram view in the diagram tab.



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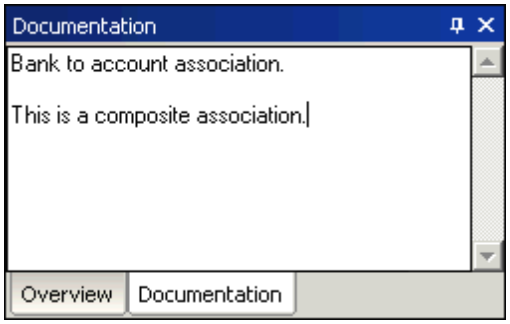
4.8 Documentation

Documentation tab
Allows you to document any of the UML elements available in the Model Tree tab. Click the element you want to document and enter the text in the Documentation tab. The standard editing shortcuts are supported i.e. cut, copy and paste.



Documentation and code engineering:
During code engineering, only class and interface documentation is input/output. This includes documentation defined for class/interface properties and operations.

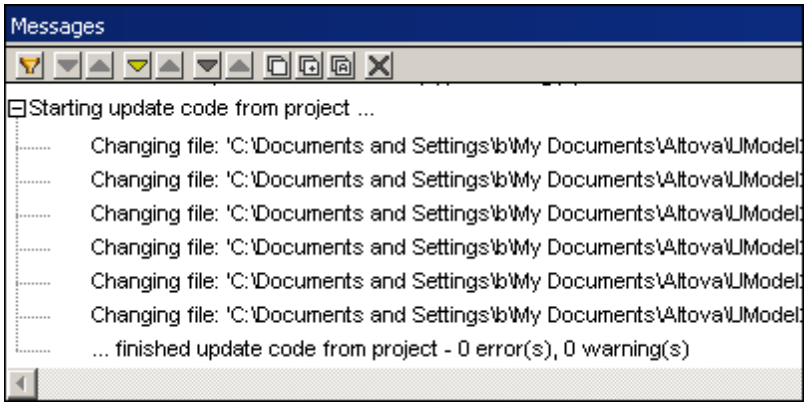
1. Select **Project | Synchronization** settings.
2. Activate the "**Write Documentation as JavaDocs"** check box to enable documentation output.

Please note:
When importing XML schemas, only the first annotation of a complex- or simpleType is displayed in the Documentation window.

4.9 Messages

The Messages window displays warnings, hints and error messages when merging code, or checking the project syntax.

Clicking the error message highlights the corresponding element in the Model Tree and also in the owning diagram, if that diagram is currently active/open.


Messages
Starting update code from project ...
Changing file: 'C:\Documents and Settings\b\My Documents\Altova\UModel
Changing file: 'C:\Documents and Settings\b\My Documents\Altova\UModel
Changing file: 'C:\Documents and Settings\b\My Documents\Altova\UModel
Changing file: 'C:\Documents and Settings\b\My Documents\Altova\UModel
Changing file: 'C:\Documents and Settings\b\My Documents\Altova\UModel
Changing file: 'C:\Documents and Settings\b\My Documents\Altova\UModel
... finished update code from project - 0 error(s), 0 warning(s)

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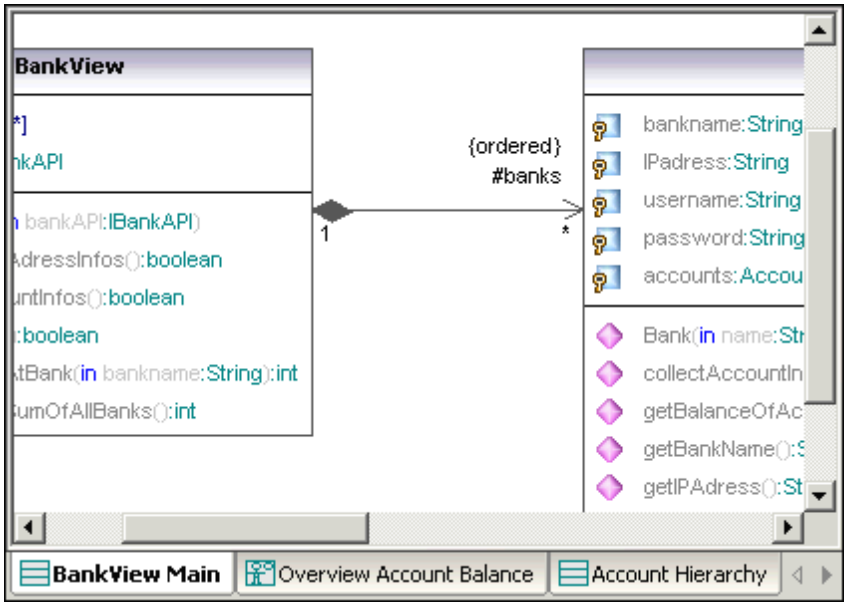
4.10 Diagram pane

The diagram pane displays all the currently opened UModel diagrams as individual tabs.



To create a new diagram:

1. Click a package in the Model Tree tab.
2. Select **New | YYY Diagram**.

To create a new diagram containing contents of an existing package:

1. Right click a package and select **Show in new Diagram | Content**.

To open / access a diagram:

- Double click the diagram **icon** in any of the Model Tree pane tabs (to open).
- Clicking any of the tabs in the Diagrams pane (to access).

To close all but the active diagram:

- Right click the diagram tab that is to remain open, select the option **Close All but active**.

Deleting a diagram:

- Click the diagram icon in the Model Tree and press Del. key.

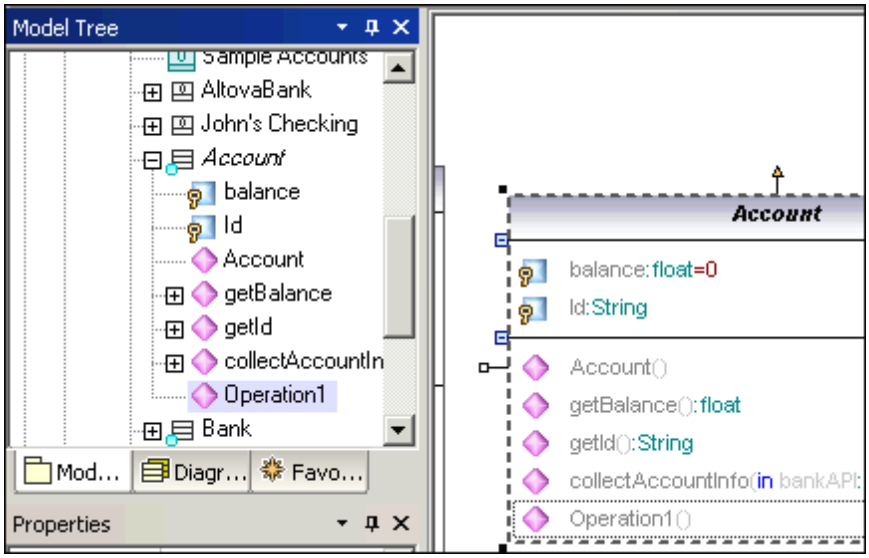
Moving diagrams in a project:

- Drag the diagram icon to any other package in the Model Tree Tab.
  You might have to enable the "no sort" option to move it.

Finding (deleting) class properties and options from the Model Tree:

Properties and options can also be deleted directly from the Model Tree. To do this safely, it is important to first find the correct property. Assuming you have inserted "Operation1" in the Account class (press F8, then Enter to insert):

1. Right click Operation1 in the Account class.
2. Select the option "**Select in Model Tree**" or press F4.
   The Operation1 item is now highlighted under *Account* in the Model Tree tab.



3. Press the **Del** key to delete the operation from the **class** and **project!**
   Note that almost any modeling element can be found in the Model Tree when pressing F4.

Please note:
It is also possible to navigate from the Properties pane to the Model Tree when viewing an attributes properties, please see: the Properties in the User Interface section.

Deleting elements from a diagram:

Delete element from the **diagram** and **project**!

- Select the element you want to delete and press the Del. keyboard key.

Delete element **from diagram only** - not from the project!

1. Select the element you want to "delete"
2. Hold down the **CTRL** key and press **Del**.

An auto-layout function allows you to define how you would like your diagram to be visually structured. Right click the diagram background and select either:

- Autolayout All | Force directed, or
- Autolayout All | Hierarchic
- Autolayout All | Block

Showing relationships between modeling elements:

1. Right click the specific element and select **Show**.
   The popup menu shown below is context specific, meaning that only those options are available that are relevant to the specific element.

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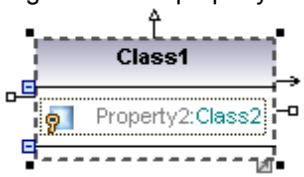
To show / hide text labels:

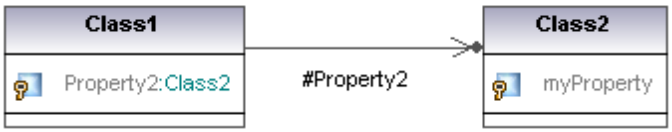
- Right click a class or association arrow and select **Text labels | Show (Hide) all Text labels**.

To show a class attribute/property as an association:

1. Right click the property in the class.



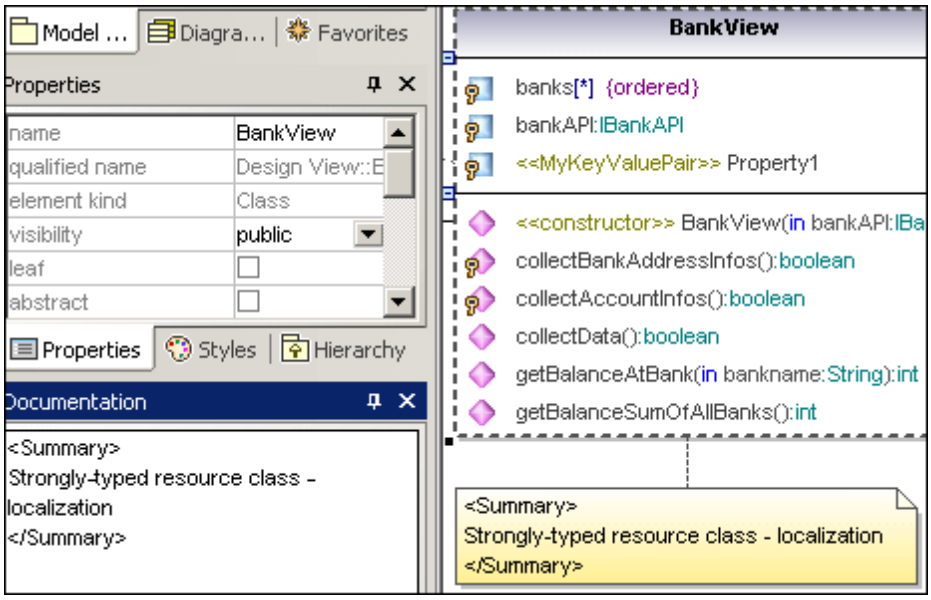
2. Select the menu option **Show | "PropertyXX" as Association**.
   This inserts/opens the referenced class and shows the relevant association.



To show source code comments in the model diagram:

- Right click the class in the diagram pane and select **Show | Annotating comments**.

  This allows you to directly edit source code DocComments, also visible in the Documentation window, in the modeling diagram.



To adjust the line thickness (weight) in a project:

1. Click in any diagram, then click the Styles tab.
   Making sure that the Project Styles entry in the combo box is active
2. Scroll down to Line thickness and select the value that you want.
   This affects the thickness of all association, aggregation, generalization etc. lines in all diagrams of the current UModel project.

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4.10.1 Diagram properties

Configuring diagram properties

Click on the diagram background and then select one of the styles from the Styles combo box. Please see Styles pane for more information.

To enlarge the Diagram size:
The size of the diagram tab is defined by the elements and their placement.

- Drag an element to one of the diagram tab edges to automatically scroll the diagram tab and enlarge it.

Positioning modeling elements - the grid

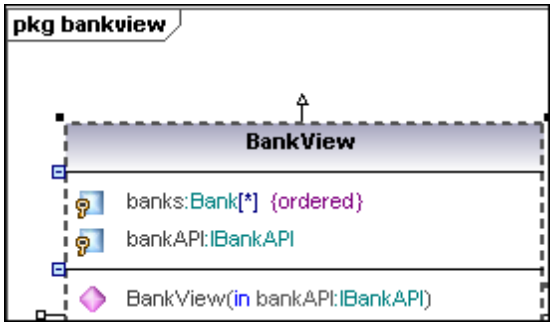
Modeling elements can be positioned manually, or made to snap to a visible/invisible grid in a diagram.

toggles between showing / hiding the grid

toggles between snapping elements to the visible / invisible grid

Displaying the UML diagram heading

toggles between displaying the UML diagram heading, i.e. the frame around a diagram with its name tag in the top left corner.



Aligning modeling elements

Modeling elements can be aligned, and resized, in relation to other elements e.g. all centered, left or right aligned etc.

Please note:
When marking several objects, the action that you apply uses the element that was selected **last** as the template you apply. E.g. if you mark three class elements and click the "Make same Width" icon, then all three will be made as wide as the last class you selected.

This also applies when marking several objects using the marquee, the element last selected by the marquee becomes the template element whose properties are applied to the other marked objects.

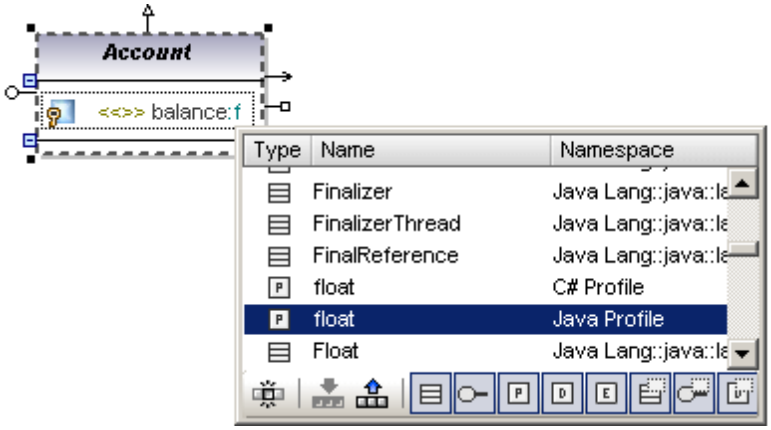
Icon functions for each icon group:
Align Left, align Right

Align Top, align Bottom
Center vertically, center horizontally
Space Across, Space down
Line up horizontally, line up vertically.
Make same width, make same height, make same size.

Enhanced autocompletion window - selecting datatypes

When inputting datatypes for operations or properties, an autocomplete window is automatically opened. The autocompletion popup has the following features:

- Clicking a column name sorts the window by that attribute in ascending/descending order.
- The window can resized by dragging the bottom right corner.
- The window contents can be filtered by clicking the respective category icons at the bottom of the window.
- The **Single mode** icon lets you switch between enabling only one of the category icons at any one time (single mode), or enabling multiple category icons (multi mode). Ths shot below shows the autocompletion window in "multi-mode", i.e. all category icons are enabled. The single mode icon is not enabled.
- The Set all / Clear all Categories icons, set or clear all categories icons.
- On-demand popup pressing CTRL+Space, when autocompletion is disabled.



Filter categories:
Class, Interface, PrimitiveType, DataType, Enumeration, Class Template, Interface Template, DataType Template.

Please note:
To enable/disable the autocompletion select **Tools | Options | Diagram Edting** tab, then click the "Enable automatic entry helper" option. The on-demand availability is not affected by this setting however.

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4.10.2 Cut, copy and paste in UModel Diagrams

Cut, Copy and Paste of diagram elements within the Diagram pane
All UModel diagram elements can be cut, copied and pasted within, across the same type, and even into other types of diagram tab. Mouse or keyboard shortcuts can be used to achieve this in two different ways:

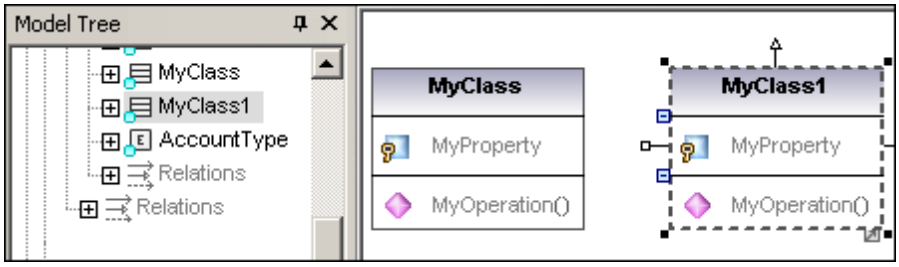
Having copied an element:

- "**Paste**", using the keyboard shortcut CTRL+V, or "Paste" from the context menu, as well as Paste from the Edit menu, always adds a **new** modeling element to the diagram and to the Model Tree.
- "**Paste in diagram only**", using the context menu, i.e. right clicking on the diagram background, only adds a "link/view" of the existing element, to the current diagram and not to the Model Tree.

Using the Class diagram as an example:

Paste (CTRL+V) of a copied **class**:

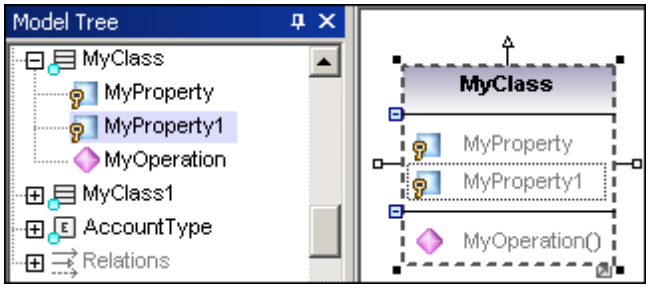
- **Pasting** a copied class in the same diagram (or package), inserts a **new class** with the source class name plus a sequential number. E.g source class name is **myClass**, pasted class name is **myClass1.** All operations and properties are also copied to the new class.



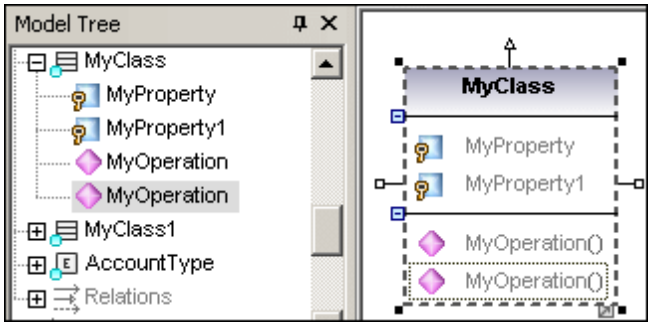
- **Pasting** a copied class into a different package, also inserts a **new** class, but keeps the original class name.
- In both cases the new class is also added to the Model Tree as well.

Paste (CTRL+V) of copied **Properties** or **Operations**:

- **Pasting** a Property in the same class, inserts a **new** property with the source property name plus a sequential number e.g. MyProperty1.



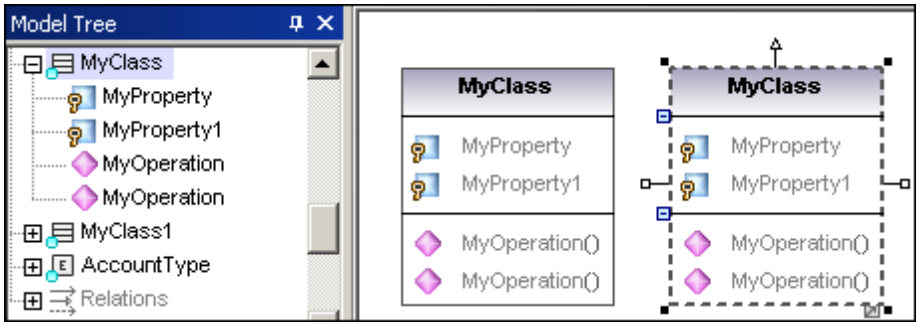
- **Pasting** an Operation in the same class, inserts a **new** operation of the same name as the source operation.



- In both cases a new property/operation is added to the Model Tree.

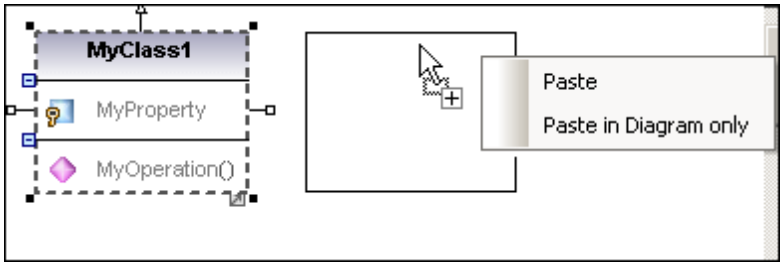
"Paste in Diagram only":
Whenever you use the context menu and select this option, a "link", or "view" to the element is created in the **diagram** you paste it into. Using the Class diagram as an example:

- "Paste in diagram only", creates a "view" to the original class
- The class is inserted into the diagram and displayed exactly as the source class
- A **new** class has **not** been added to the Model Tree!
- No class name or other Operation/Property changes are made
- Changing element properties in one of the "views", changes it in the other one automatically



Copy and pasting of elements using the mouse:

1. Click on the modeling element you want to copy.
2. Move the mouse pointer to the position you want to place the new element.
3. Hold down the CTRL key. A small plus appears below the mouse pointer to signify that this is a copy procedure.
4. Release the mouse button.



A popup menu appears at this point allowing you to select between Paste, and Paste in Diagram only.

5. Select the option that you would like to perform.

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Please note:

Using the mouse and CTRL key allows you to copy, or move properties and operations directly within a class.

4.11 Adding/Inserting model elements

Model elements can be created and inserted into diagrams using several methods:

- By adding the elements to specific packages, in the Model Tree view
- By dragging existing elements from the Model Tree tab into the diagram tab
- By clicking a specific UML element icon, and inserting it into the diagram
- By using the context menu to add elements to the diagram (and automatically to the Model Tree view).

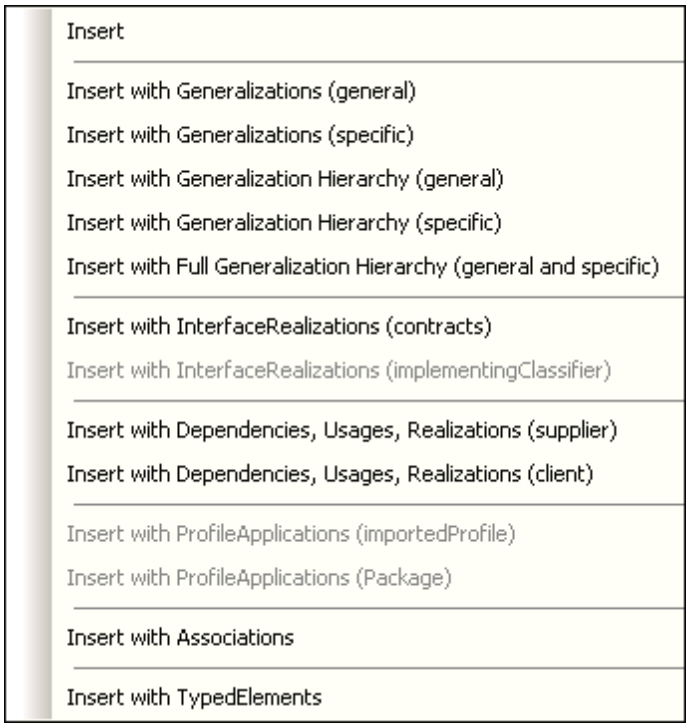
  Please note that multiple elements can be selected in the Model Tree using either SHIFT +click, or CTRL+click.

Adding elements in the Model Tree/Favorites tab:

- Right click a package, select New, and then select the specific element from the submenu.
  This adds the new element to the Model Tree tab in the current project.

Inserting elements from the Model Tree view into a diagram:
Model elements can be inserted individually, or as a group. To mark multiple elements use the CTRL key and click each item. There are two different methods of inserting the elements into the diagram: drag left, and drag right.

- **Drag left** (normal drag and drop) inserts elements immediately at the cursor position (any associations, dependencies etc. that exist between the currently inserted elements and the new one, are automatically displayed).
- **Drag right** (holding down the right mouse button and releasing it in the diagram tab) opens a popup menu from which you can select the specific associations, generalizations you want to display.


Insert
Insert with Generalizations (general)
Insert with Generalizations (specific)
Insert with Generalization Hierarchy (general)
Insert with Generalization Hierarchy (specific)
Insert with Full Generalization Hierarchy (general and specific)
Insert with InterfaceRealizations (contracts)
Insert with InterfaceRealizations (implementingClassifier)
Insert with Dependencies, Usages, Realizations (supplier)
Insert with Dependencies, Usages, Realizations (client)
Insert with ProfileApplications (importedProfile)
Insert with ProfileApplications (Package)
Insert with Associations
Insert with TypedElements

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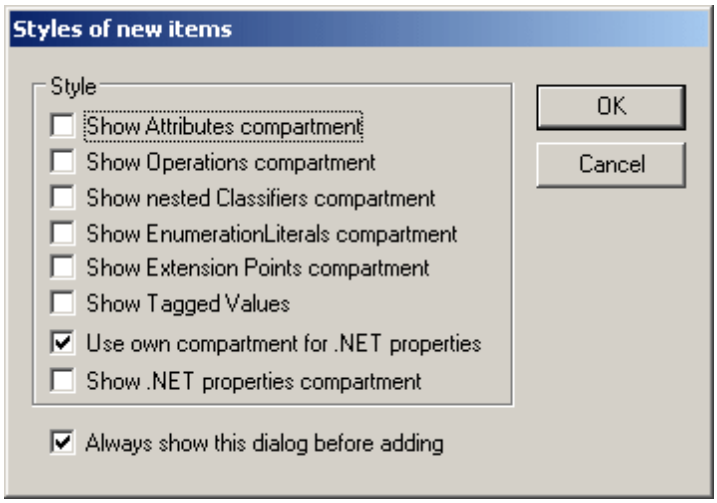
Example:
You want to replicate the Account Hierarchy diagram in a new class diagram.

1. Right click the **bankview** package and select **New | Class Diagram**.
2. Locate the abstract *Account* class in the model tree, and use **drag right** to place it in the new diagram.
   The context menu shown above, is opened.
3. Select the **Insert with Generalization Hierarchy (specific)** item.



4. Deselect the check boxes for specific items you want to appear in the elements (Properties and Operations in this case).
5. Click OK.
   The Account class **and its three subclasses**, are all inserted into the diagram tab. The Generalization arrows are automatically displayed.

Adding elements to a diagram using the icons in the icon bar:

1. Select the specific element you want to insert by clicking the associated icon in the icon bar.
2. Click in the diagram tab to insert the element.

Please note:
Holding down the CTRL key before clicking in the diagram tab, allows you to insert multiple elements of the same type with each individual click in the diagram.

Adding elements to a diagram using the context menu:

- Right click the diagram background and select **New | element name**.

Please note:
Adding new elements directly to the diagram tab, automatically adds the same element to the Model Tree tab. The element is added to the package containing the UML diagram in the Model Tree view.

- Right click an element and select **Show | xx**
  E.g. Right clicking the Account class and selecting **Show | Generalization hierarchy**. This then inserts the derived classes into the diagram as well.

4.12 Hyperlinking modeling elements

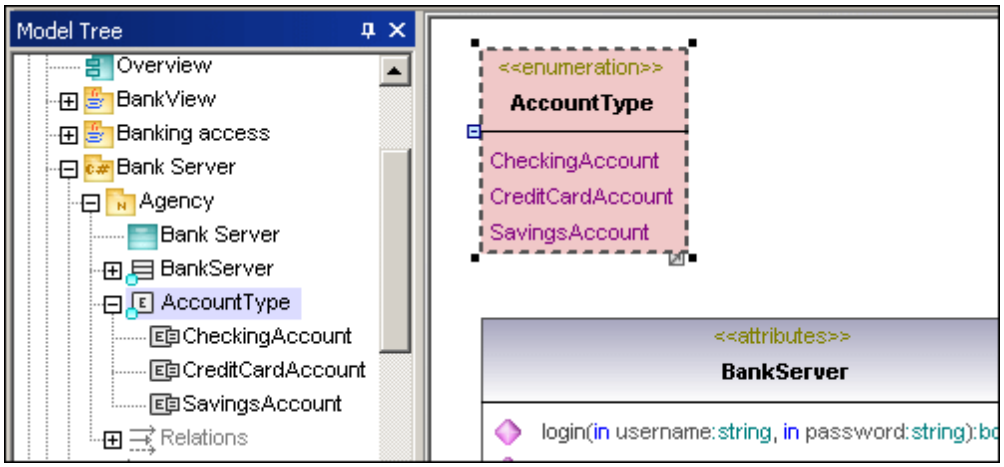
UModel now supports automatic and manual hyperlinking of modeling elements. Automatic hyperlinking occurs when selecting the specific setting when importing source code, or binary files, into a model.

Manual hyperlinks are created between most modeling elements (except for lines) and:

- any diagram in the current *.UMP project
- any element on a diagram
- any element in the Model Tree
- external documents, e.g. PDF, Excel or Word documents
- web pages

Note:
All manually created hyperlinks are also available in the HTML project documentation when generating UML documentation.

Opening the Bank Server diagram under the Bank Server package displays the IBankAPI interface as well as the BankServer class. An enumeration element containing the names of the EnumerationLiterals is also visible. What we want to do is create a hyperlink from the Enumeration to the Account Hierarchy class diagram.



To create a diagram hyperlink:

1. Right click the element and select **Hyperlinks | Insert/Edit hyperlinks**.

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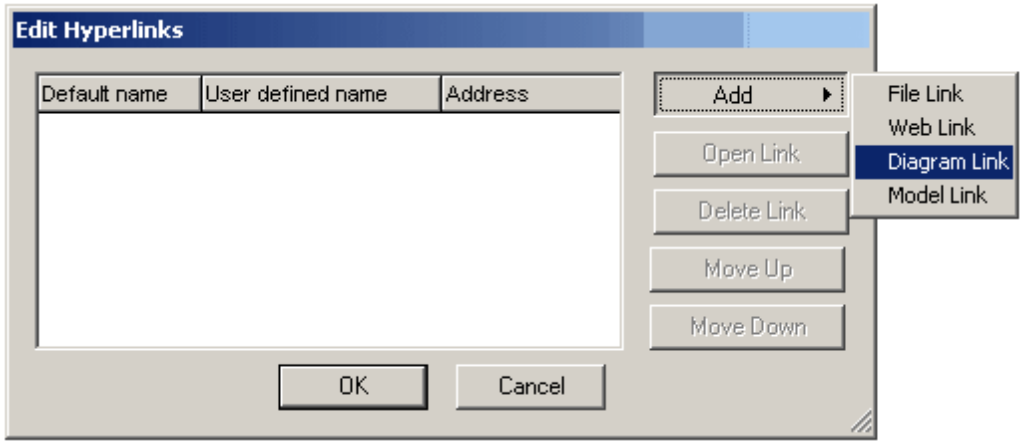
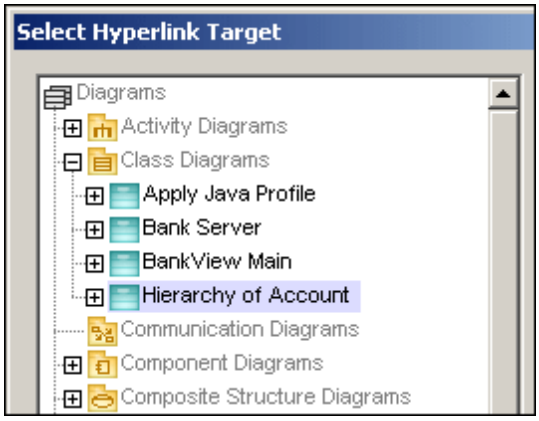
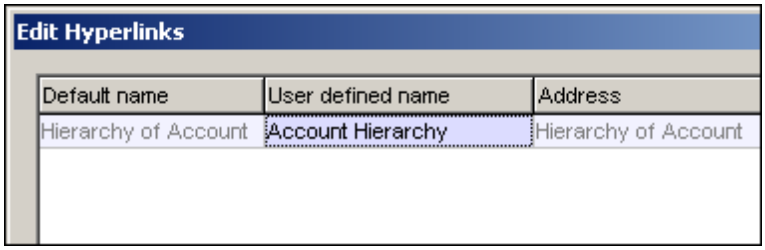


This opens the Edit Hyperlinks dialog box in which you manage the hyperlinks.

2. Click the **Add button** and select **Diagram Link** to define a link to an existing diagram.

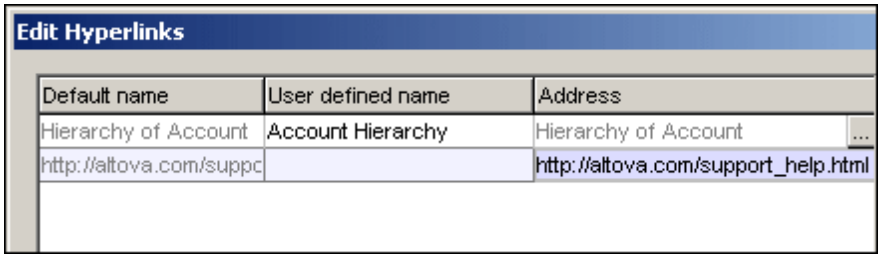


3. Select the hyperlink target that you want to be able to navigate to, e.g. Hierarchy of Account diagram, and click OK.

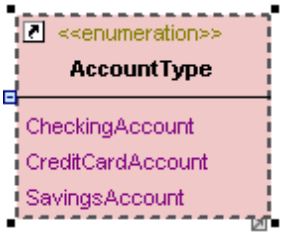


Double clicking in the User defined name column allows you to define your own link name.

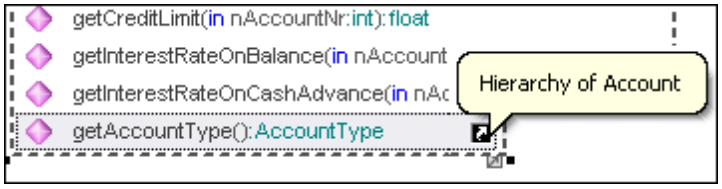
Note that you can add multiple, as well as different kinds of links from a single modeling element e.g. a web link to http://altova.com/support_help.html using the **Add | Web Link**.



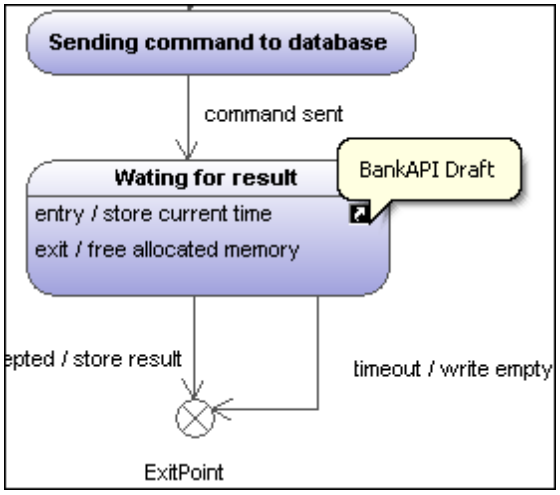
4. Click OK when you have finished defining your hyperlinks.
   A link icon has now been added to the top left of the enumeration element. Placing the mouse cursor over the link icon, displays a popup with the name of the target element.



Hyperlinks on operations



Hyperlinks from a state machine entry action



To create a link to a specific Diagram element (Diagram Link):

1. Create the hyperlink as before but click the + sign to expand the diagram contents.

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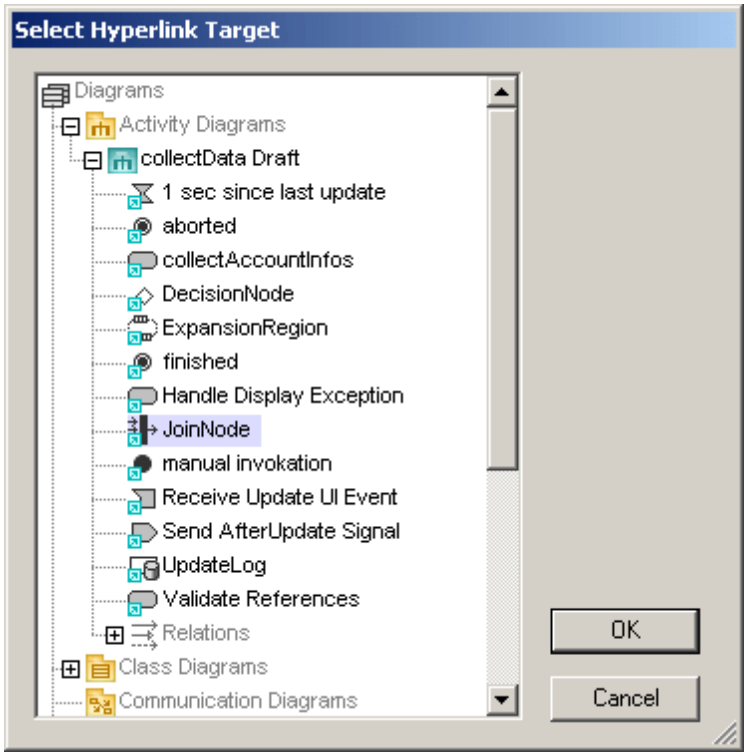


2. Select the specific modeling element you want to link to and click OK to confirm.

   Clicking the link icon opens the designated diagram with the element visible and selected.

To create a link to an element in the Model Tree (Model Link):

- Use the same method as described above, but click **Add | Model Link** in the dialog box. Clicking the link once it has been inserted, navigates to the specific element you selected from the dialog box in the **Model Tree**.

  Note: when generating project documentation, the hyperlinks to the model elements in the Model Tree are adjusted to point to the correct definitions in the generated documentation.

To create a link to a document:

1. Click the **Add | File Link** in the Edit Hyperlinks dialog box.
2. Select the document that you want to link e.g. *.DOC, *.XLS, *.PDF etc.

To create a hyperlink from a note:

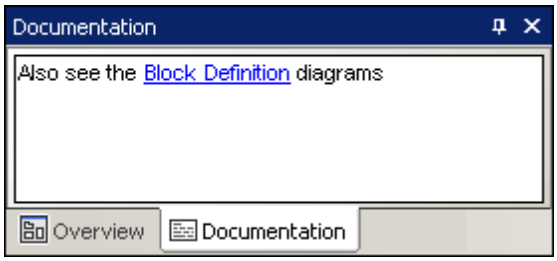
1. Select the text in the note by dragging, or double clicking a word.
2. Right click the selected text and select the menu object **Insert/Edit Hyperlinks**.
3. Use the Edit Hyperlinks dialog box to create a link to a diagram.

Please note:

Use the same method to create hyperlinks from **Comment** elements.

To create a link from the Documentation tab:

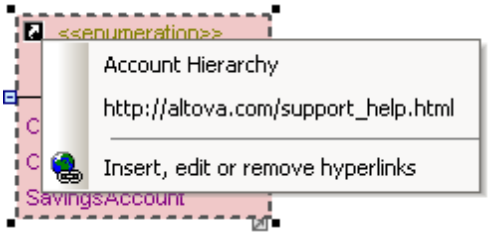
1. Enter the explanatory text into the Documentation tab.
2. Select the text you want to use as a link
3. Right click and select the type of link you want to create.



To navigate to a hyperlink target:

1. Click the hyperlink icon in the modeling element.
   If only one target is defined then the target diagram, website etc., will appear immediately.

   If multiple targets were defined, a popup dialog appears allowing you to select one of the available targets.



   Clicking the first item opens the Hierarchy of Account diagram.

Navigating hyperlinks:

- Click the Previous and Next icons, in the main icon bar, to navigate the source and destination links.

To edit/change a hyperlink target:

1. Right click the link icon and select **Insert, edit or remove hyperlinks** item.
2. Use the Edit Hyperlinks dialog box in to manage your hyperlinks.

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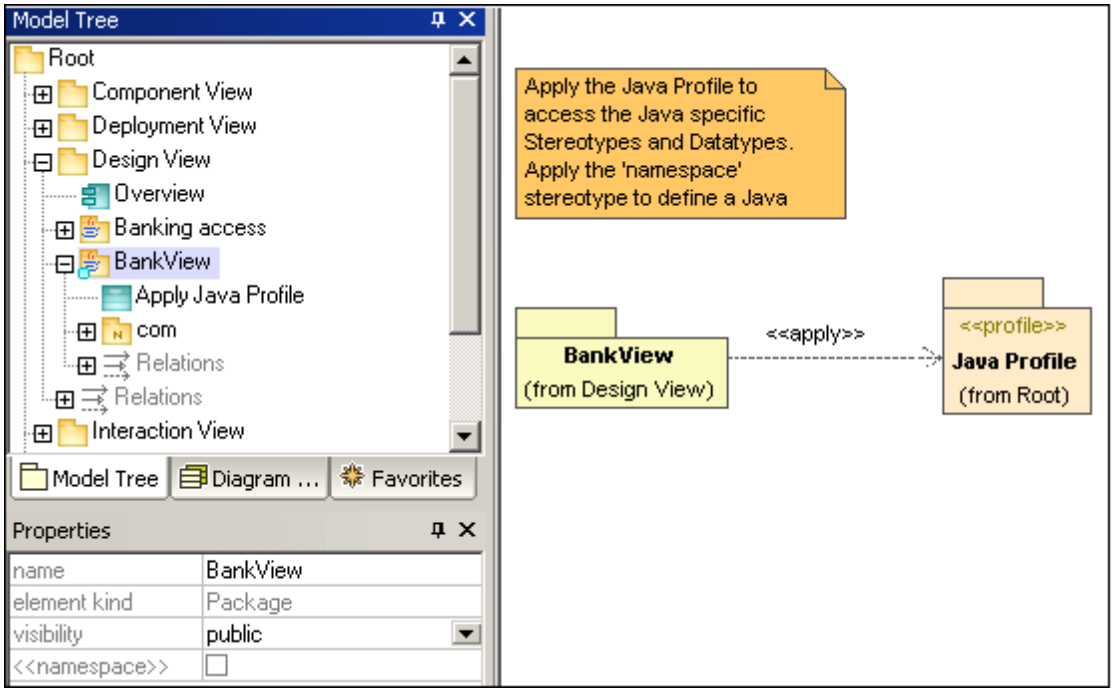
4.13 Bank samples

The ...**UModelExamples** folder contains sample files which show different aspects of UML modeling in UModel. They are designed to show language specific models for Java, C# and a combination of both languages in one modeling project.

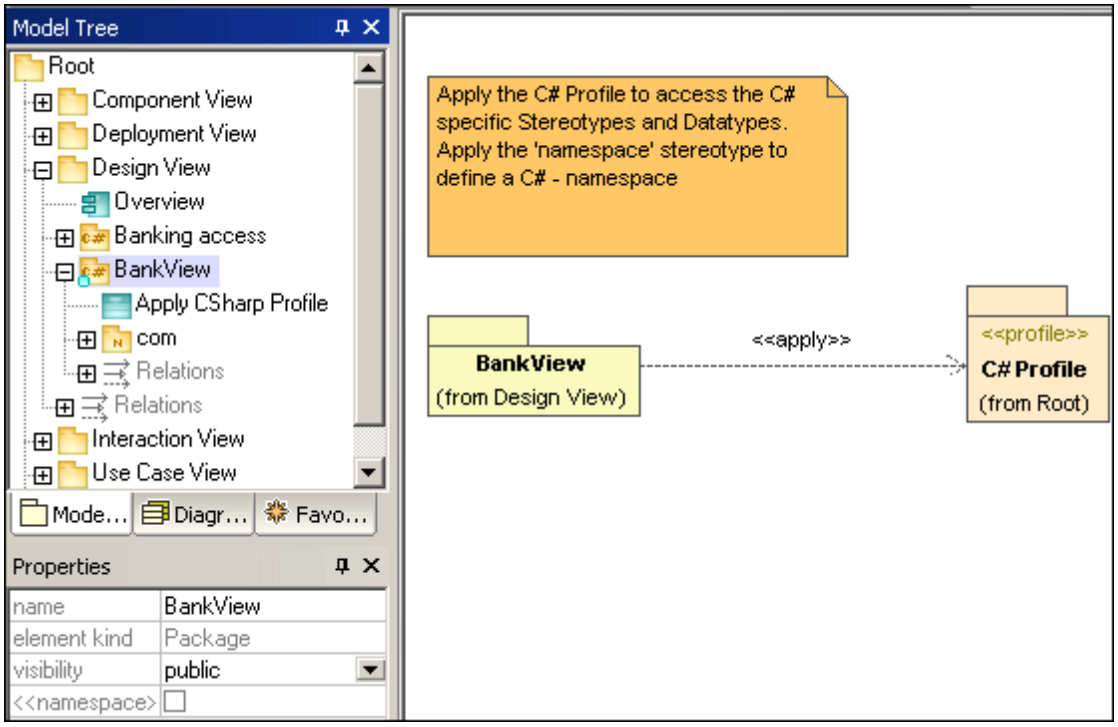
The **Bank_Java.ump** sample file is shown below:

- the Java profile has been assigned to the Bankview package
- the Java namespace root has been assigned to the Banking access and BankView packages.
- the Interaction View package contains two interaction elements which each contain a sequence diagram.



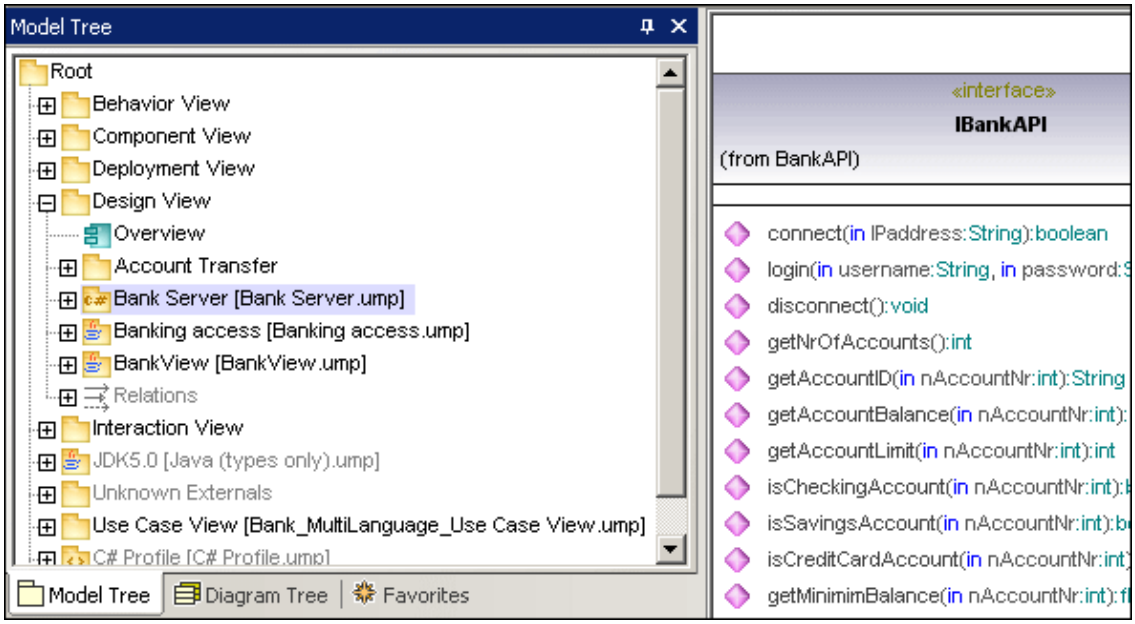
The **Bank_CSharp.ump** sample file is shown below:

- the C# profile has been assigned to the BankView package
- the C# namespace root has been assigned to the Banking access and BankView packages.
- the Interaction View package contains two interaction elements which each contain a sequence diagram.



The **Bank_MultiLanguage.ump** sample file is shown below:

- the Java profile has been assigned to the BankView package
- the C# namespace root has been assigned to the Bank Server package
- the Java namespace root has been assigned to the BankView package.
- the Interaction View package contains two interaction elements which each contain a sequence diagram.
- the project has been split up into 4 editable subprojects, Bank Server.ump, Banking access.ump, BankView.ump and Bank_Multilanguage_Use Case View.ump.



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Chapter 5

UModel Command Line Interface

5 UModel Command Line Interface

In addition to the graphical user interface, UModel also has a command line interface. To open the command line interface, run the **UModelBatch.exe** file available in the **C:\Program Files\Altova\UModel2016** directory. If you run UModel 32-bit on a 64-bit operating system, the path is **C:\Program Files (x86)\Altova\UModel2016**.

The command line parameter syntax is shown below, and can be displayed in the command prompt window by entering: **umodelbatch /?**

Note: If the path or file name contains spaces, enclose it in quotes, for example: "c:\Program Files\...\MyProject.ump".

```
usage: umodelbatch [project] [options]

/? or /help ... display this help information

project    ... project file (*.ump) see also File: New/Load/Save options
/new[=file] ... create/save/save as new project
/set        ... set options permanent
/gui        ... display UModel user interface

commands (executed in given order):
/chk        ... check project syntax
/isd=path   ... import source directory
/isp=file   ... import source project file
                (*.project,*.xml,*.jpx,*.csproj,*.csdproj,*.vbproj,*.vbdpro
j,*.sln,*.bdsproj)
/ibt=list   ... import binary types (specify binary[typenames] list)
                (';'=separator, '*'=all types, '#' before assembly names)
/ixd=path   ... import XML schema directory
/ixs=file   ... import XML schema file (*.xsd)
/m2c        ... update program code from model (export/forward engineer)
/c2m        ... update model from program code (import/reverse engineer)
/ixf=file   ... import XMI file
/exf=file   ... export to XMI file
/inc=file   ... include file
/mrg=file   ... merge file
/doc=file   ... write documentation to specified file
/lue[=cpri] ... list all elements not used on any diagram (i.e. unused)
/ldg        ... list all diagrams
/lcl        ... list all classes
/lsp        ... list all shared packages
/lip        ... list all included packages

options for save as new project:
/npad=opt   ... adjust relative file paths (Yes | No | MakeAbsolute)

options for import commands:
/iclg=lang  ... code language (Java1.4 | Java5.0 | Java6.0 | Java7.0 |
Java8.0 | C#1.2 | C#2.0 | C#3.0 | C#4.0 | VB7.1 | VB8.0 | VB9.0)
/ipsd[=0|1] ... process sub directories (recursive)
/irpf[=0|1] ... import relative to UModel project file
/ijdc[=0|1] ... JavaDocs as Java comments
```

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```
/icdc[=0|1] ... DocComments as C# comments
/icds[=lst] ... C# defined symbols
/ivdc[=0|1] ... DocComments as VB comments
/ivds[=lst] ... VB defined symbols (custom constants)
/imrg[=0|1] ... synchronize merged
/iudf[=0|1] ... use directory filter
/iflt[=lst] ... directory filter (presets /iudf)

options for import binary types (after /iclg):
/ibrt=vers  ... runtime version
/ibpv=path  ... override of PATH variable for searching native code
libraries
/ibro[=0|1] ... use reflection context only
/ibua[=0|1] ... use add referenced types with package filter
/ibar[=flt] ... add referenced types package filter (presets /ibua)
/ibot[=0|1] ... import only types
/ibuv[=0|1] ... use minimum visibility filter
/ibmv[=key] ... keyword of required minimum visibility (presets /ibuv)
/ibsa[=0|1] ... suppress attribute sections / annotation modifiers
/iboa[=0|1] ... create only one attribute per attribute section
/ibss[=0|1] ... suppress 'Attribute' suffix on attribute type names

options for diagram generation:
/dgen[=0|1] ... generate diagrams
/dopn[=0|1] ... open generated diagrams
/dsac[=0|1] ... show attributes compartment
/dsoc[=0|1] ... show operations compartment
/dscc[=0|1] ... show nested classifiers compartment
/dstv[=0|1] ... show tagged values
/dudp[=0|1] ... use .NET property compartment
/dspd[=0|1] ... show .NET property compartment

options for export commands:
/ejdc[=0|1] ... Java comments as JavaDocs
/ecdc[=0|1] ... C# comments as DocComments
/evdc[=0|1] ... VB comments as DocComments
/espl[=0|1] ... use user defined SPL templates
/ecod[=0|1] ... comment out deleted
/emrg[=0|1] ... synchronize merged
/egfn[=0|1] ... generate missing file names
/eusc[=0|1] ... use syntax check

options for XMI export:
/exid[=0|1] ... export UUIDs
/exex[=0|1] ... export UModel specific extensions
/exdg[=0|1] ... export diagrams (presets /exex)
/exuv[=ver] ... UML version (UML2.0 | UML2.1.2 | UML2.2 | UML2.3 | UML2.4)

options for merge file:
/mcan=file  ... common ancestor file

options for documentation generation:
/doof=fmt   ... output format (HTML | RTF | MSWORD | PDF)
/dsps=file  ... SPS design file
```

In the projects section:

- The **/new** parameter defines the path and file name of the new project file (*.ump). It can also be used to save an existing project under a different name e.g. **UmodelBatch.exe MyFile.ump /new=MyBackupFile.ump (**see also File: New/Load/Save options).
- The **/set** parameter overwrites current default settings in the registry, with the options/ settings defined here.
- The **/gui** parameter displays the UModel interface during the batch process.

Example 1

The following command imports source code and creates a new project file. Notice that the project path contains spaces and is enclosed in quotes.

```
"C:\Program Files\Altova\UModel2016\UModelBatch.exe" /new="C:\Program Files
\Altova\UModel2016\UModelBatchOut\Fred.ump" /isd="X:TestCases\UModel\Fred" /
set /gui /iclg=Java5.0 /ipsd=1 /ijdc=1 /dgen=1 /dopn=1 /dmax=5 /chk
```

/**new**:	Specifies that the newly-created project file should be called "Fred.ump" in C: \Program Files\Altova\r j çÇ OMNS\UModelBatchOut\
/**isd=**	Specifies that the root directory to import into should be "X:\TestCases\UModel \Fred"
/**set**:	Specifies that any options used in the command line tool will be saved in the registry (When subsequently starting UModel, these settings become the default settings).
/**gui**:	Display the UModel GUI during batch processing.
/**iclg**:	UModel will import the code as Java5.0.
/**ipsd**=1:	Recursively process all subdirectories of the root directory specified in the /**isd** parameter.
/**pfd**=1:	Create packages in the UModel project for each imported directory.
/**ijdc**=1:	Create JavaDoc from comments where appropriate.
/**dgen**=1:	Generate diagrams.
/**dopn**=1:	Open generated diagrams.
/**dmax**=5:	Open a maximum of five diagrams.
/**chk**:	Perform a syntax check.

Example 2

The following command imports source code from **X:\TestCases\UModel**, and saves the resulting project file to **C:\Program Files\Altova\UModel2016\UModelBatchOut\finalclass.ump**.

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```
"C:\Program Files\Altova\UModel2016\UModelBatch.exe" /new="C:\Program Files
\Altova\UModel2016\UModelBatchOut\finalclass.ump" /isd="X:\TestCases\UModel
\" /iclg=Java5.0 /ipsd=1 /ijdc=1 /dgen=1 /dopn=1 /dmax=5 /dsat=1 /dsnc=1 /chk
```

/**dsat**=1	Suppress attributes in the generated diagrams.
/**dsnc**=1	Suppress nested classifiers in the generated diagrams.

Example 3

The following command synchronizes code using an existing project file ("C:\Program Files\Altova \UModelOMNS\UModelBatchOut\Fred.ump").

```
"C:\Program Files\Altova\UModel2016\UModelBatch.exe" "C:\Program Files\Altova
\UModel2016\UModelBatchOut\Fred.ump" /m2c /ejdc=1 /ecod=1 /emrg=1 /egfn=1 /
eusc=1
```

/**m2c**	Update the code from the model.
/**ejdc**:	Comments in the project model should be generated as JavaDoc.
/**ecod**=1:	Comment out any deleted code.
/**emrg**=1	Synchronize the merged code.
/**egfn**=1:	Generate any missing file names in the project.
/**eusc**=1	Use the syntax check.

5.1 File: New / Load / Save options

Full batch mode i.e. **/gui** parameter not used.

new

UModelBatch /new=xxx.ump (options)
creates a new project, executes options, xxx.ump is always saved (regardless of options)

auto save

UModelBatch xxx.ump (options)
loads project xxx.ump, executes options, xxx.ump is saved **only** if document has changed (like **/ibt**)

save

UModelBatch xxx.ump (options) /new
loads project xxx.ump, executes options, xxx.ump is **always** saved (regardless of options)

save as

UModelBatch xxx.ump (options) /new=yyy.ump
loads project xxx.ump, executes options, always saves xxx.ump as yyy.ump (regardless of options)

Batch mode with **UModel user interface** visible i.e. **/gui** parrameter used.

new

UModelBatch /gui /new (options)
creates a new project, executes options, nothing saved, the GUI is left open

save new

UModelBatch /gui /new=xxx.ump (options)
creates a new project, executes options, xxx.ump saved, the GUI is left open

user mode

UModelBatch /gui xxx.ump (options)
loads project xxx.ump, executes options, nothing saved, the GUI is left open

save

UModelBatch /gui xxx.ump (options) /new
loads project xxx.ump, executes options, xxx.ump is saved, the GUI is left open

save as

UModelBatch /gui xxx.ump (options) /new=yyy.ump
loads project xxx.ump, executes options, xxx.ump is saved as yyy.ump, the GUI is left open

The project will be saved successfully provided that no critical errors occur while executing the options.

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Chapter 6

Projects and code engineering

6 Projects and code engineering

UModel now supports all Java specific constructs, among them:

- Java annotations
- Attributes, operations and nested qualifiers for EnumerationLiterals
- Enumerations can realize interfaces
- Netbeans project files

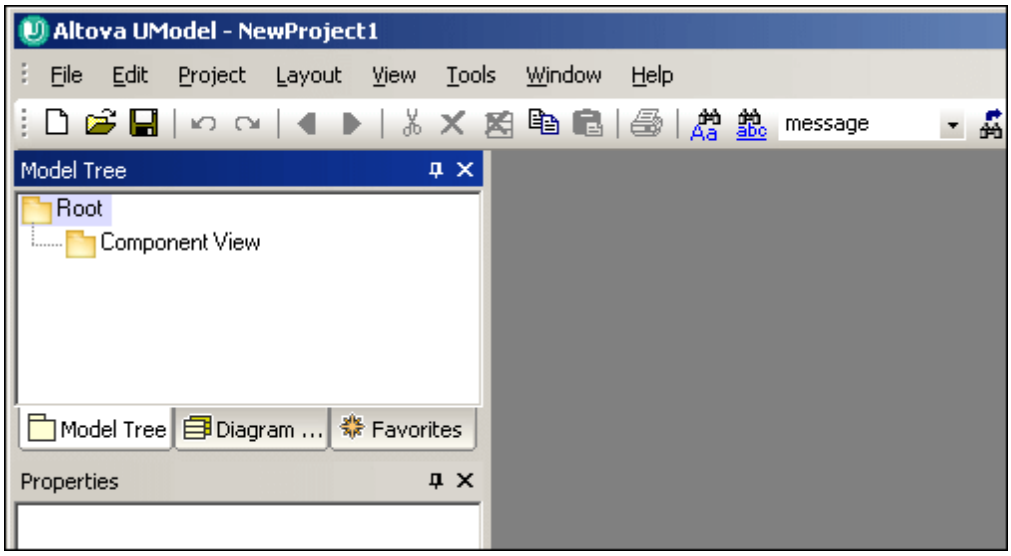
Reverse engineering now supports:

- The ability to generate a single diagram for all reverse engineered elements
- Possibility to show/hide anonymous bound elements on diagrams
- Ability to automatically create hyperlinks from packages to their corresponding package content diagrams during the import process.
- Ability to resolve aliases.
- Writing of Unicode characters into new source code files
- Ability to create associations from .NET properties

To create a new project:

1. Click the **New** icon in the icon bar, (or select the menu item **File | New**).

The Root and Component packages are automatically inserted when a new project is created, and are visible in the Model Tree tab. A new project with the default name NewProject1 is created. Note that starting UModel opens a new project automatically.



A newly created UModel project consists of the following packages:

- Root package, and
- Component View package
  These two packages are the only ones that cannot be renamed, or deleted.

All project relevant data is stored in the UModel project file, which has an *.**ump** extension. Each folder symbol in the Model Tree tab represents a UML package.

UModel Project workflow:

UModel does not force you to follow any predetermined modeling sequence.

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You can add any type of model element: UML diagram, package, actor etc., to the project in any sequence (and in any position) that you want; Note that all model elements can be inserted, renamed, and deleted in the Model Tree tab itself, you are not even forced to create them as part of a diagram.

To insert a new package:

1. Right click the package you want the new package to appear under, either Root, or Component View in a new project.
2. Select **New | Package**.

   A new package is created under an existing one. The name field is automatically highlighted allowing you to enter the package name immediately.

- Packages are the containers for all other UML modeling elements, use case diagrams, classes, instances etc.
- Packages can be **created**, at any position in the Model Tree.
- Packages/contents can be **moved**/copied to other packages in the Model Tree (as well as into valid model diagrams in the diagram tab).
- Packages and their contents can be **sorted** (in the Model Tree tab) according to several criteria.
- Packages can be placed within other packages.
- Packages can be used as the **source**, or **target** elements, when merging, or synchronizing code.

To have elements appear in a UML diagram, you have to:

1. Insert a new UML diagram, by right clicking and selecting **New | (Class) Diagram**.
2. Drag and drop an existing model element from the Model Tree into the newly created Diagram, or
3. Use the context menu within the diagram view, to add new elements directly.

To save a project:

Select the menu option **File | Save as...** (or File | Save). Note: Using the Tools | Option | File tab, you can define if you want the *.ump file to be saved in a "pretty-print" format on saving.

To open a project:

Select the menu option **File | Open,** or select one of the files in the file list.

Please note:

Changes made externally to the project file, or included file(s), are automatically registered and cause a prompt to appear. You can then choose if you want to reload the project or not.

To move a project:

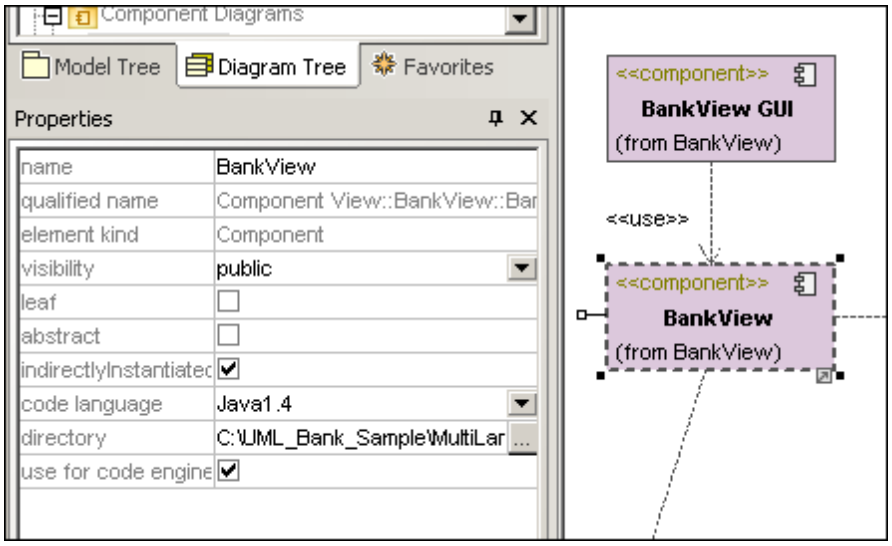
UModel projects and generated code can be easily moved to a different directory (or a different computer) and be resynchronized there.

There are two ways to do this:

- Select the menu option **File | Save As...**, and answer **Yes** at the prompt if you want to adjust the file paths to the new project location.
- Copy the UModel project (*.ump) to a new location, adjust the paths of the code generation package(s) in the Component Diagram view to the new directory location.

  E.g. using BankMultilanguage.ump:

1. Open the Component Diagram "**Overview**" and click the BankView component.
2. Update the entry in the **directory** field to the new project location.
3. Re-synchronize the model and code.



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6.1 Minimalist UModel project - starting from scratch

This section describes the steps necessary to create a project from scratch and successfully generate code for a single class. Although it is very minimalist, it uses various diagrams to show how to add methods etc., it is not the absolute minimum needed to produce code.

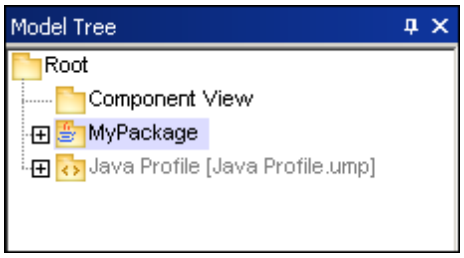
All of the actions could be achieved using only the Model Tree tab, there is no need to use modeling diagrams to create classes or methods.

Creating a new project and defining the Namespace Root

In the Model Tree pane of UModel,

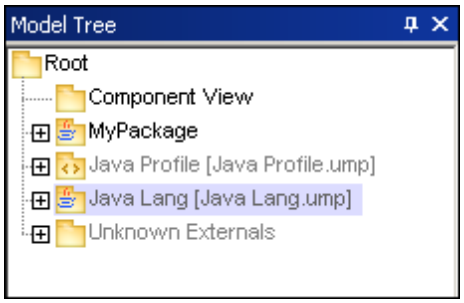
1. Select **File | New** to create a new modeling project.
2. Right click the **Root** package and select **New Element | Package**, name the package e.g. MyPackage.

3. Right click MyPackage and select **Code Engineering | Set as Java Namespace Root**, click OK to apply the UModel Java profile to the package.
   This adds a Java Profile package to the Model Tree.



Including Java Lang to supply JDK datatypes

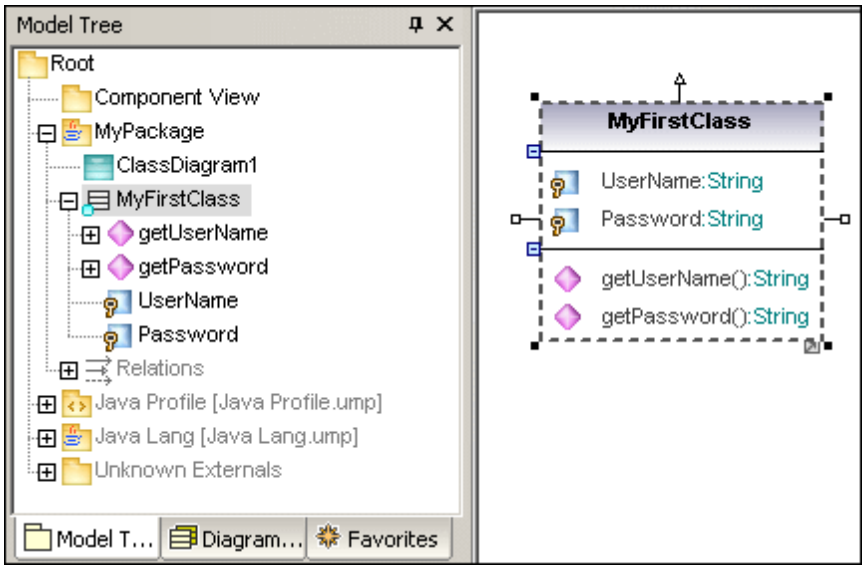
1. Click the Root package and select the menu option **Project | Include Subproject**.
2. Click the Java 1.4 tab and select the **Java Lang.ump** package. Click OK to use the default option "Include by reference".
   This adds a Java Lang, and an Unknown Externals package to the Model Tree.



Creating the class properties and methods

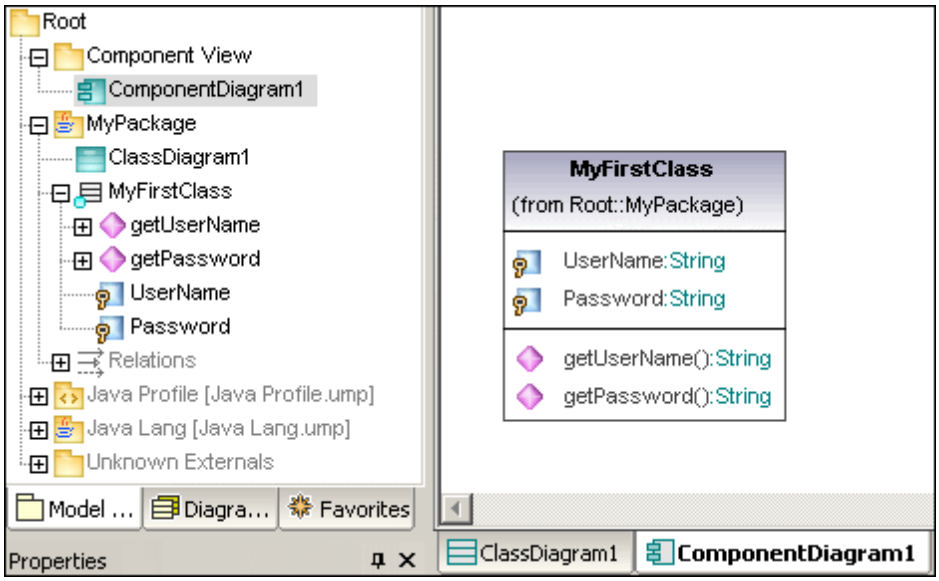
1. Right click **MyPackage** and select **New Diagram | Class Diagram**.
2. Right click in the class diagram and select **New | Class** to create a new class in the diagram e.g. **MyClass.**

3. Press F7 and add some attributes e.g. UserName:String and Password:String.
4. Press F8 and add some operations e.g. GetUserName():String and GetPassword():String.



Creating a Component and defining the code directory

1. Right click the **Component View** package and add a new Component diagram.
2. Drag the **MyFirstClass** class element from the Model Tree into the Component diagram.



3. Add a new component to the diagram e.g. **MyComponent**.
4. Click the component in the diagram to select it, then click in the **directory** field of the Properties window and enter the directory you want the code to be placed in e.g. C:\MyCode.

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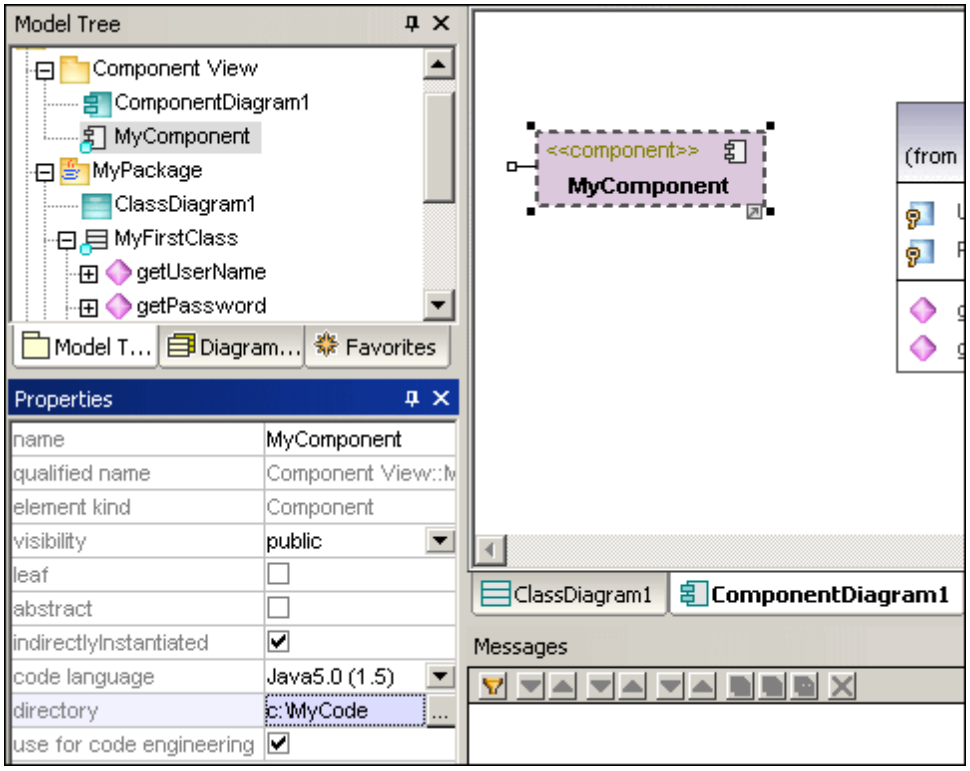
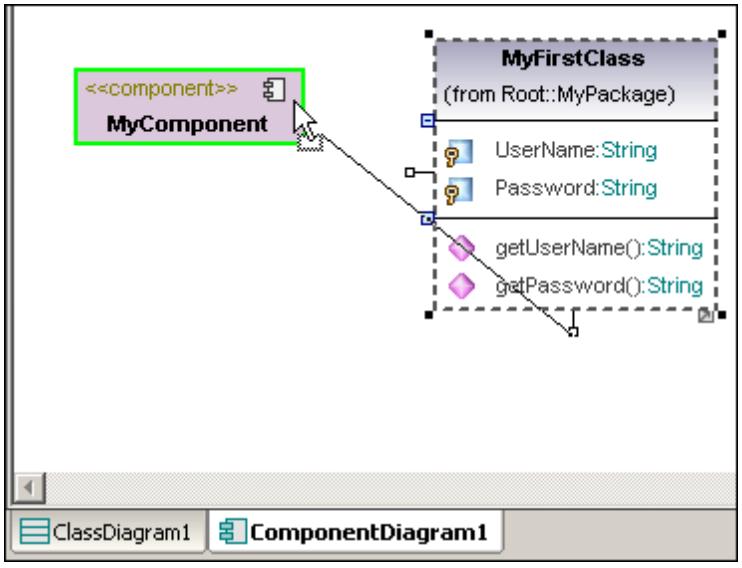


Realizing the class

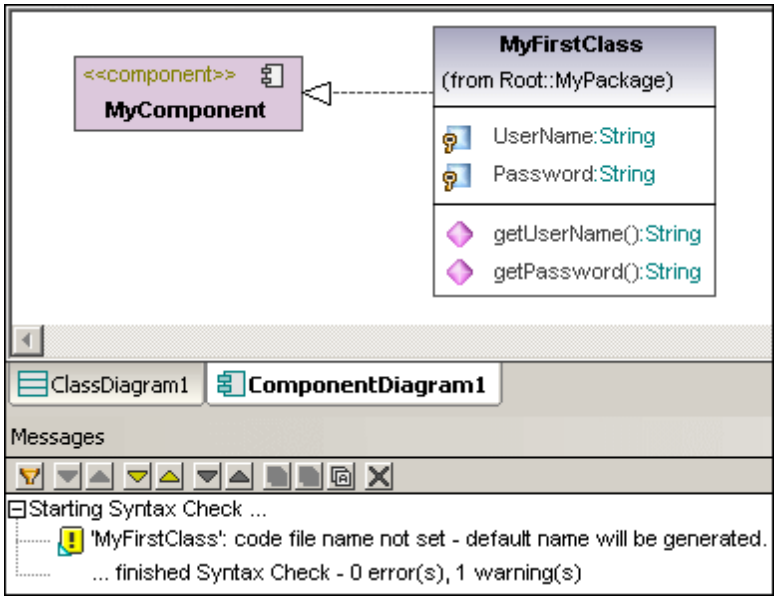
1. Click MyClass and drag the "**ComponentRealization**" handle at the bottom of the element and drop it on the new component, MyComponent.



A class has to be "realized" before code can be generated. Note that you could also drag the class and drop it on the component directly in the Model Tree.

Syntax check and generating code

1. Select **Project | Check Project Syntax** to check to see if everything is OK.



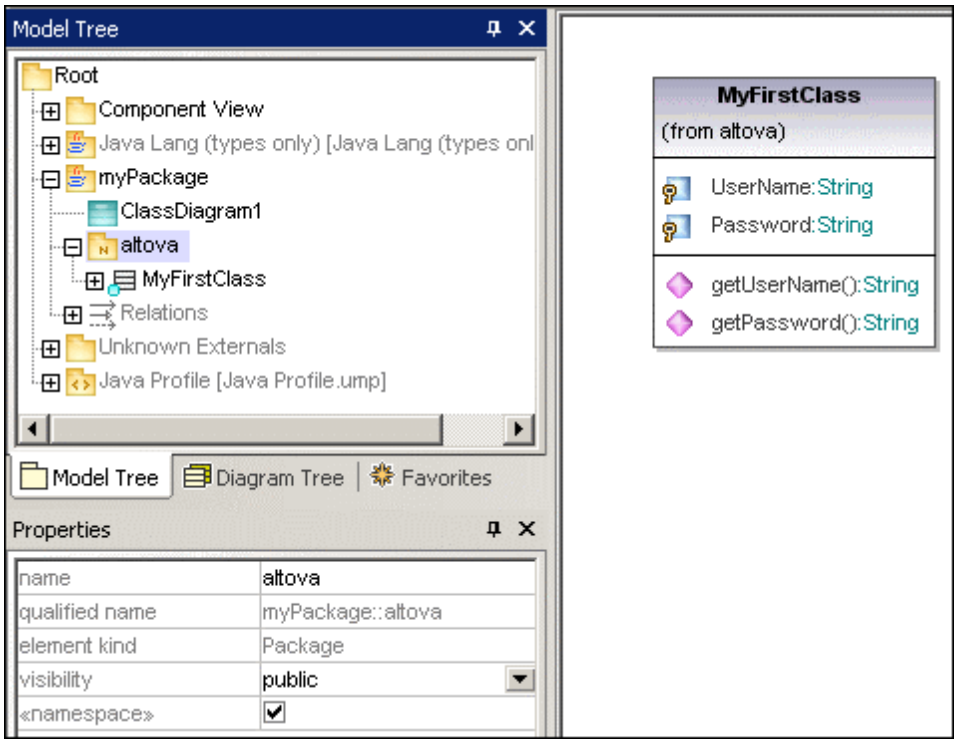
Zero errors and one warning are generated. Although the code name was not previously set, a default name will be generated automatically.

2. Select **Project | Merge Project code from UModel Project...** to output/generate the Java code.

Creating a namespace

If you want to generate the **class** inside a specific namespace:

1. Add a new package below myPackage e.g. altova.
2. Click the package and activate the <<**namespace**>> check box in the Properties window.



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3. In the Model Tree window, move the MyFirstClass class into the altova package. When code is generated, the class will now be in the namespace **altova**.

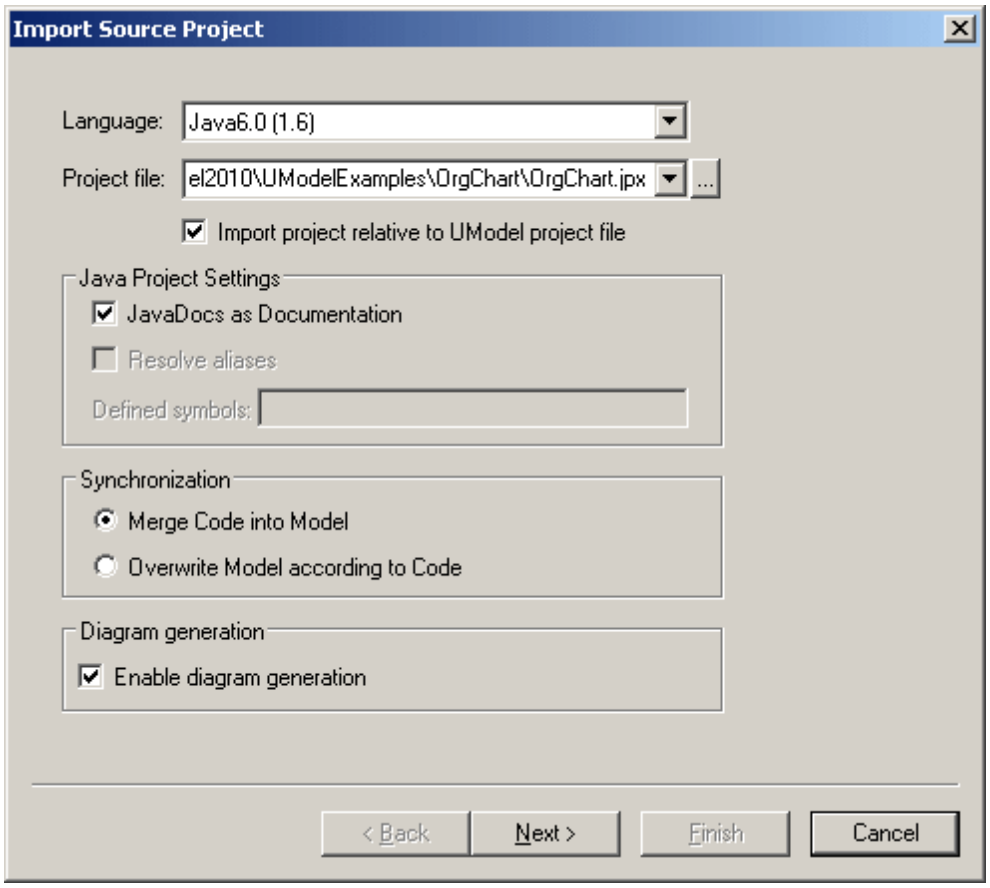
6.2 Importing source code into projects

Source code can be imported as a source project or as a source directory. For an example of importing a **source directory** please see Round-trip engineering (code - model - code) in the tutorial.

- JBuilder **.jpx,** Eclipse **.project** project files, as well as NetBeans (project.**xml**) are currently supported.
- C# projects / Visual Basic projects (Visual Studio **sln**, **csproj**, **csdprj**..., **vbproj, vbp** as well as Borland **.bdsproj** project files)

To import an existing project into UModel:

1. Select **Project | Import source project**.
2. Click the browse button ... in the "Import Source Project" dialog box.



3. Select the project file type (in this example, **.jpx**), and click Open. This JBuilder project file is available in the OrgChart.zip file in the ...**UModelExamples** folder. Note that the option to import the project relative to the UModel project file is active. To instruct UModel to generate Class Diagrams and Package Diagrams from the source code, select the "**Enable diagram generation"** check box, and click Next.
4. Activate the "Import in new package" check box (or click the respective package in the Import Target window).

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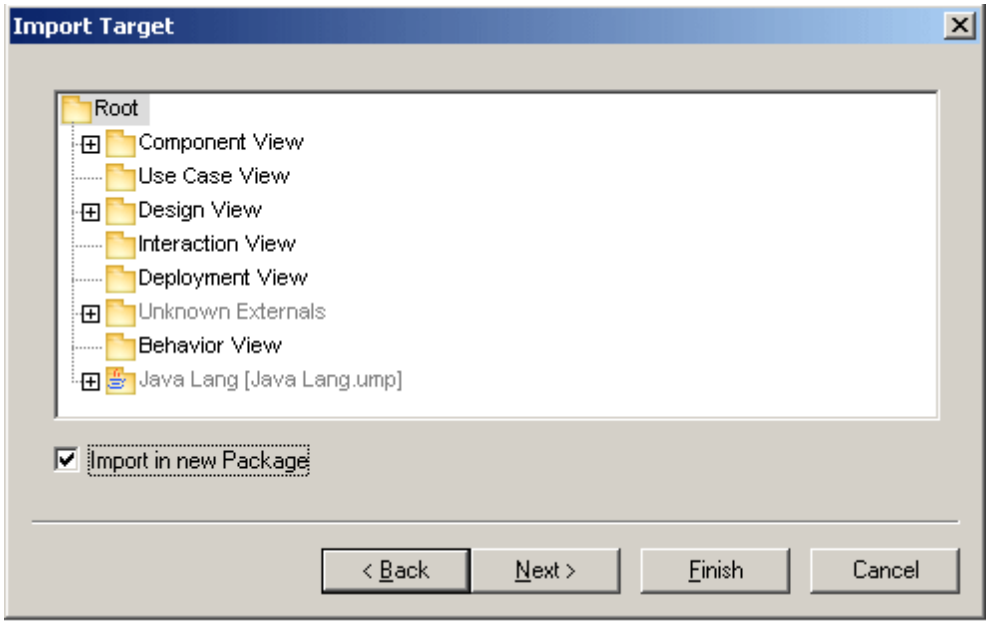
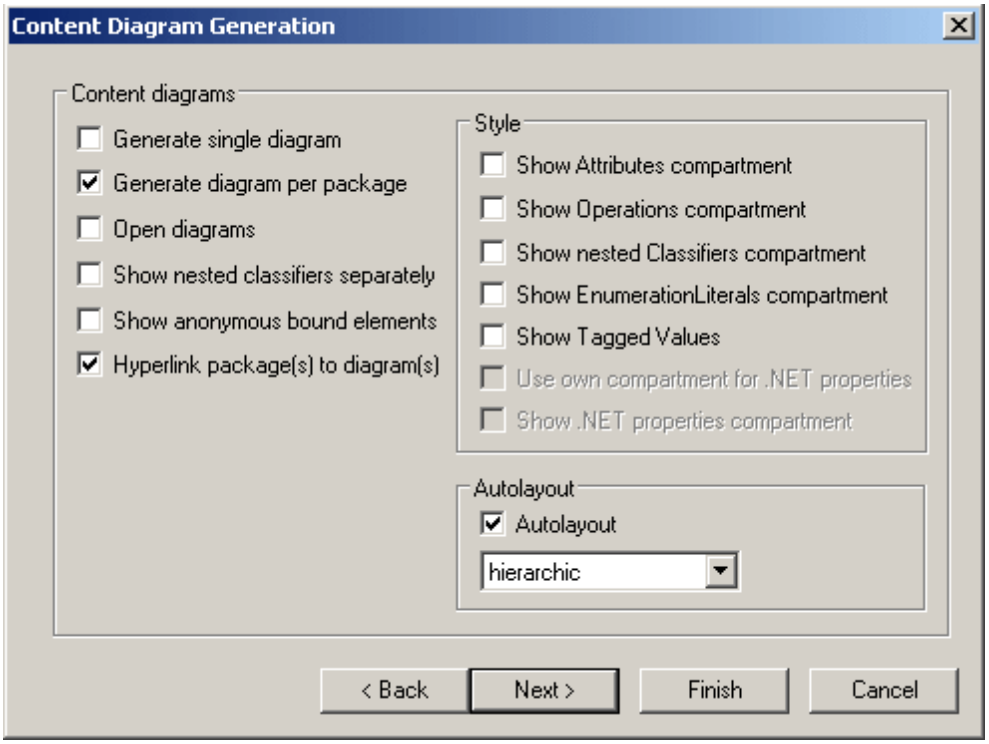
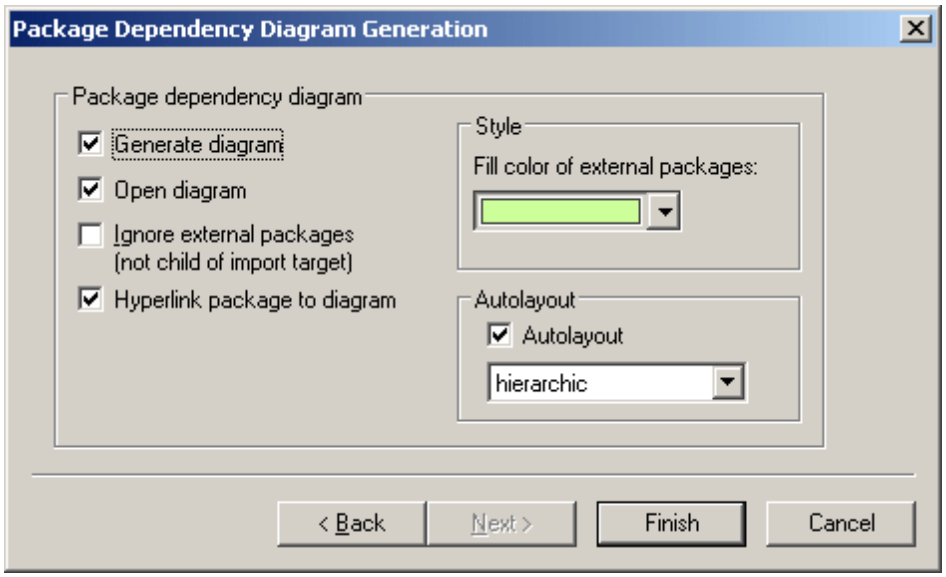


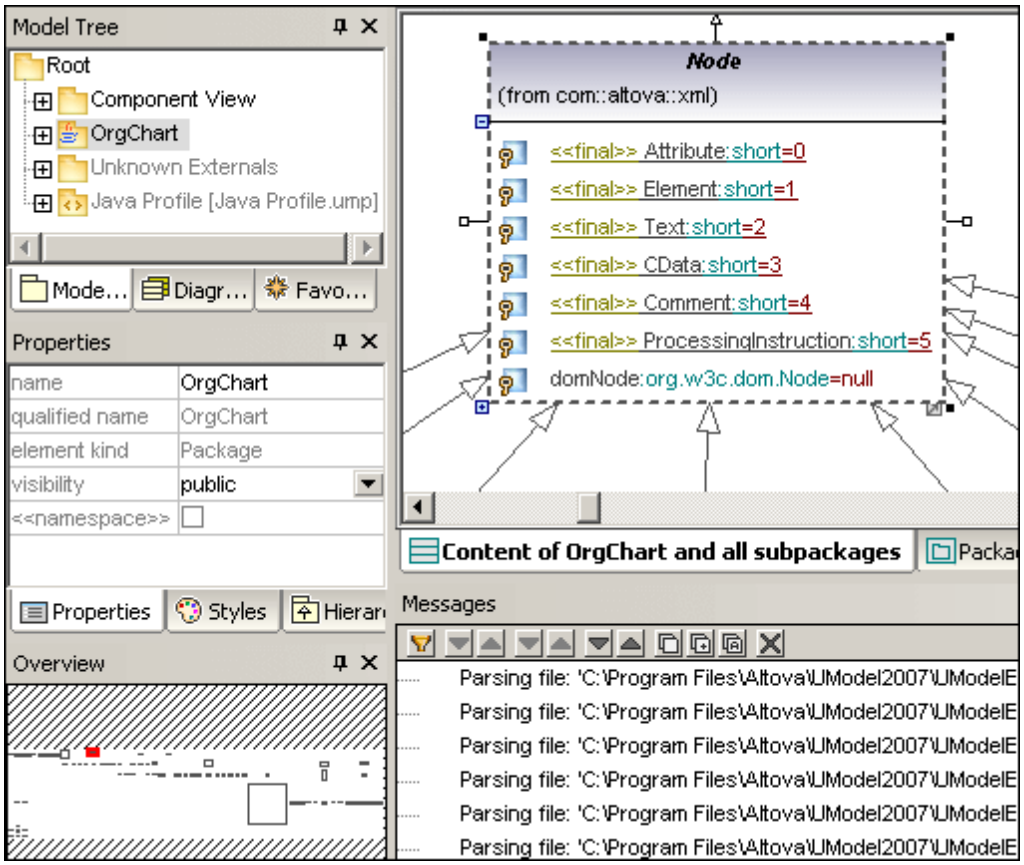
5. When prompted, select the **Generate single diagram** and/or **Generate diagram per package** options. The diagram styling options can be changed later if necessary.



6. Click Next to continue. This dialog box allows you to define the package dependency generation settings.



7. Click Finish to use the default settings. The project is parsed and the UModel model is generated.



Please note:

If you are importing into an existing project, you will be prompted for the package it should be imported into. If you are using a new project, an OrgChart folder is

automatically created.

Resolve aliases:
When reverse engineering code which contains namespace or class aliases, you can now choose if the alias is to be resolved. (Check box "Resolve aliases" in Import Source Project/Directory dialog box).

When updating code, i.e. model to code, alias definitions are retained in the code as is. The scope of the alias definitions are the files in which they appear.

e.g.

```
using Q = System.Collections.Generic.Queue<String>;
Q myQueue;
```

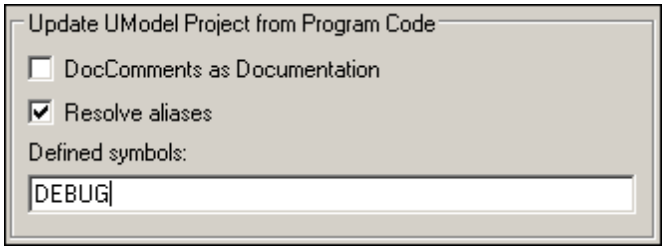
Any potentially conflicting aliases are added to the "Unknown externals" if their use is unclear.

Note:
The Resolve alias settings can be changed at any time in the Project Settings dialog box.

Defined symbols

C# or Visual Basic code allow you to enter a list of "Defined symbols" in the field of that name. These directives are used to conditionally compile sections of code. Enter these directives as a semicolon delimited list. UModel takes the defined symbols into account during the code engineering process.

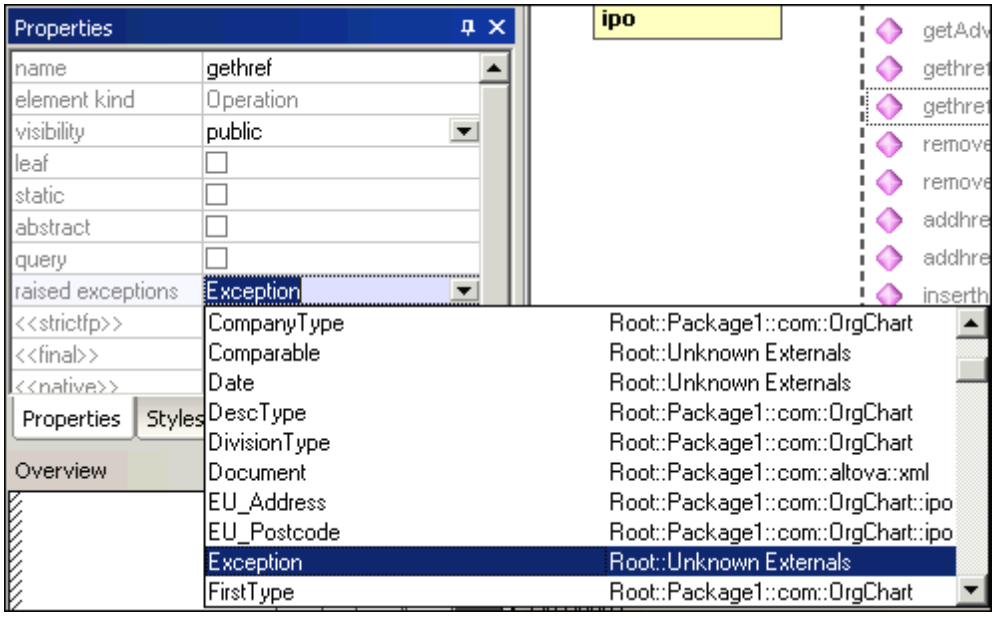
UModel outputs all symbols used in the source code in the message window, when the reverse-engineering process is completed.



E.g. #If DEBUG Then
Dim i = 10
#Else
dim a = 20
#End If

Raised exceptions

Clicking an operation in one of the classes, then clicking the **Exception** combo box, displays the exception information that an operation can throw.



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6.3 Importing Java, C# and VB binaries

UModel supports the import of C# , Java and VB binaries. This is extremely useful when working with binaries from a third party, or the original source code has become unavailable.

If you intend to import Java binary files, the Java Runtime Environment (JRE), or Development Kit (JDK) version 1.4, 1.5, 1.6, 1.7, 1.8 must be installed. Type import is supported for class archives targeting these environments, i.e. adhering to the Java Virtual Machine Specification.

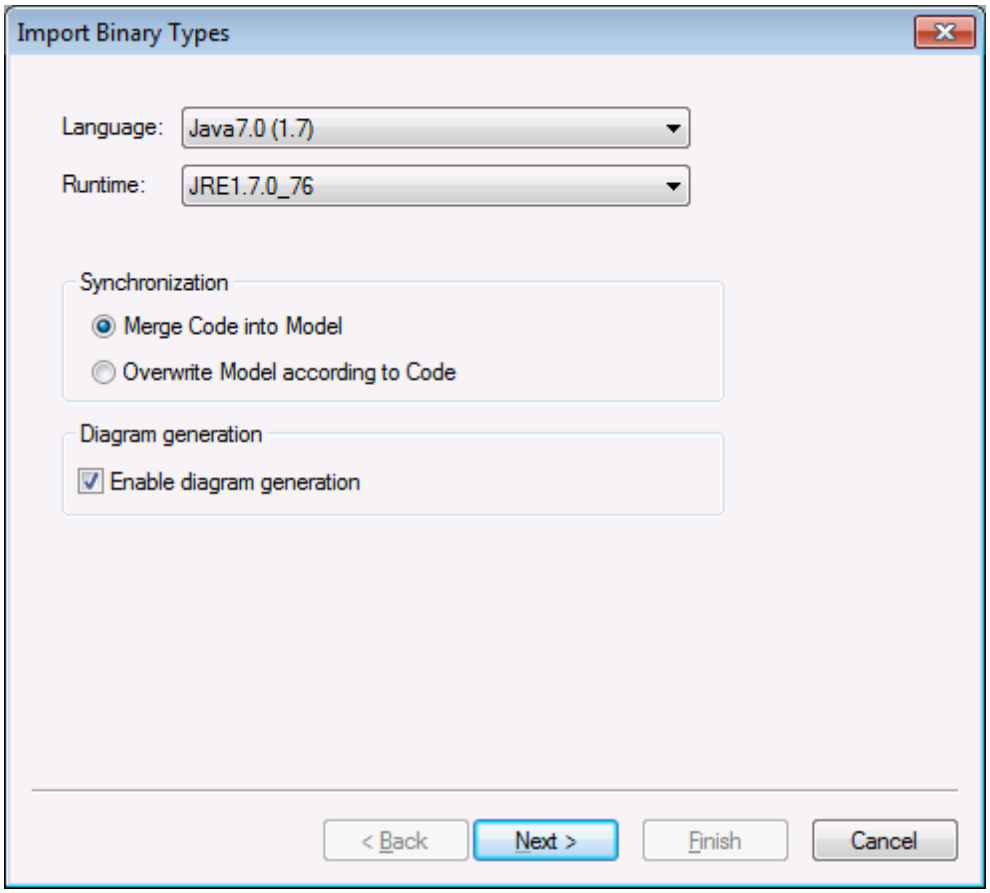
If you intend to import C# or VB binary files, the .NET Framework must be installed. Type import is supported for assemblies targeting .NET Framework 1.1, 2.0, 3.0, 3.5, 4.0, 4.5, and .NET Compact Framework v1.0, v2.0, v3.5 (for PocketPC, Smartphone, WindowsCE).

These requirements only apply if you intend to import Java or C# or VB.NET binaries; if you do not, there is no need for the Java Runtime Environment, or the .NET Framework to be installed.

The import of obfuscated binaries is not supported.

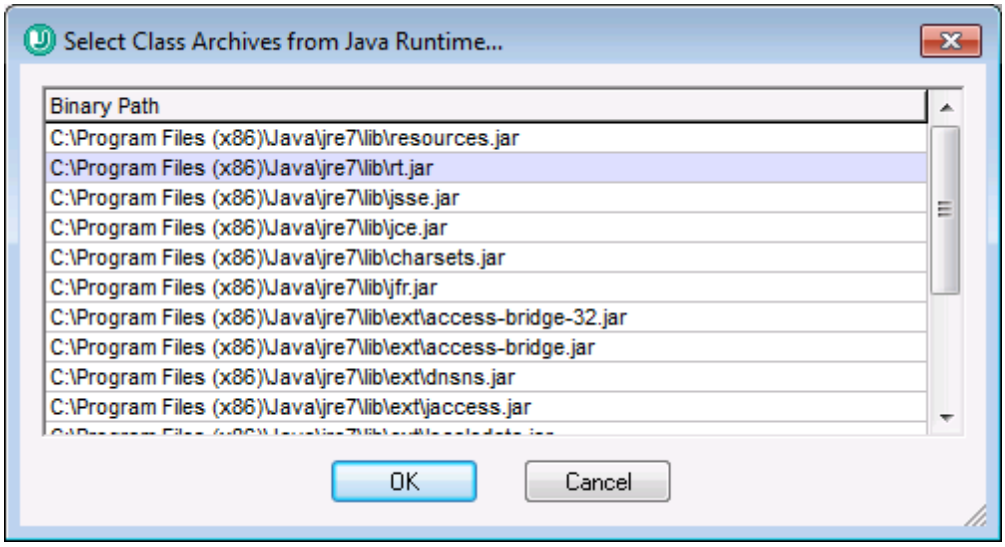
To import binary files:

1. Select the menu option **Project | Import Binary Types**.



2. Select the language and runtime edition.
3. To instruct UModel to generate Class Diagrams and Package Diagrams from the source code, select the **Enable diagram generation** check box.

4. Click Next. This opens the Import Binary Selection dialog box.
5. Click **Add** and select the Class Archive from the context menu (in this example, **Class Archives from Java Runtime**).
6. Select a binary (in this example, **rt.jar**).



7. Click the "+" expand button to expand the list of binaries, and activate the check box(es) of those that you want to import.

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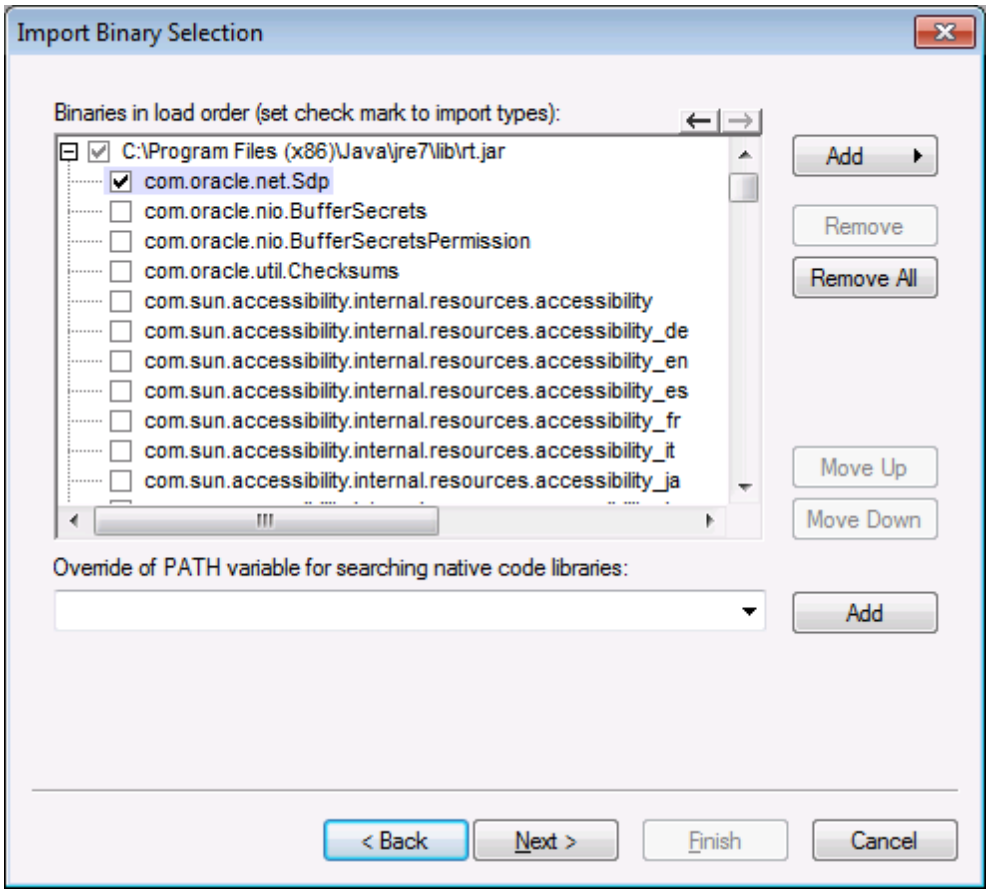
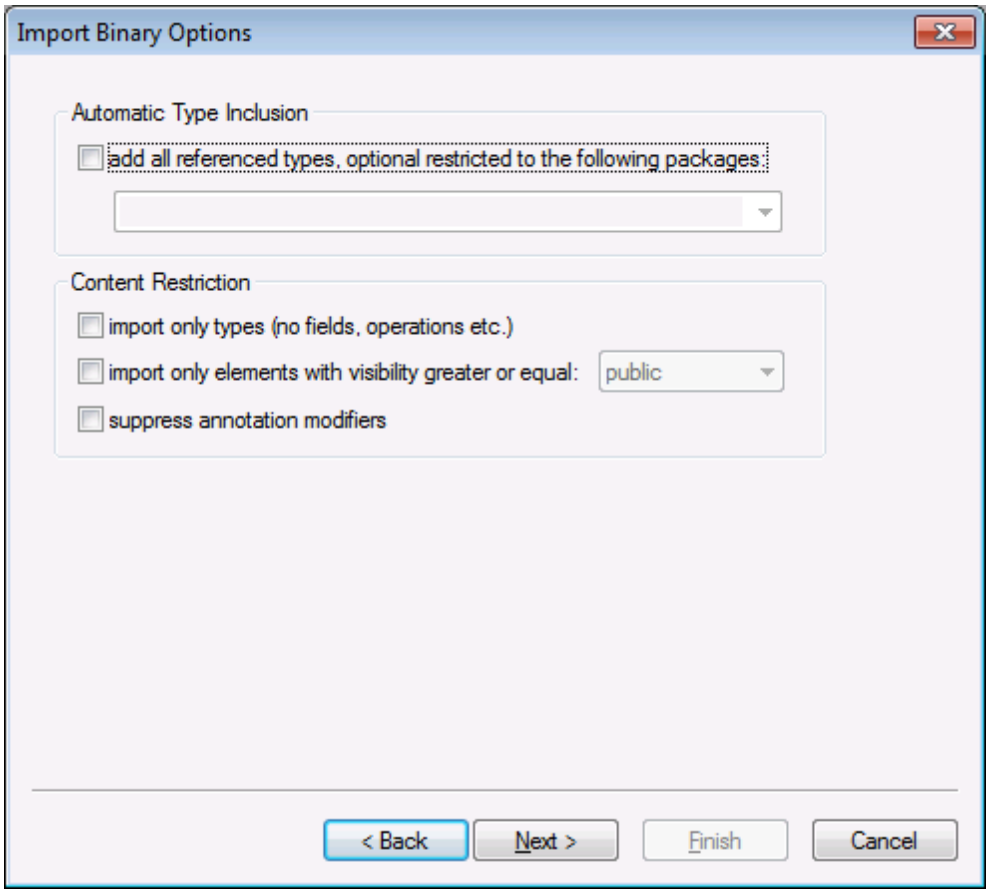


8. Click Next. This opens the **Import Binary Options** dialog box.



9. Click **Next**.
10. If prompted, define the Import Target, or select the **Import in new Package** check box, then click **Next**.

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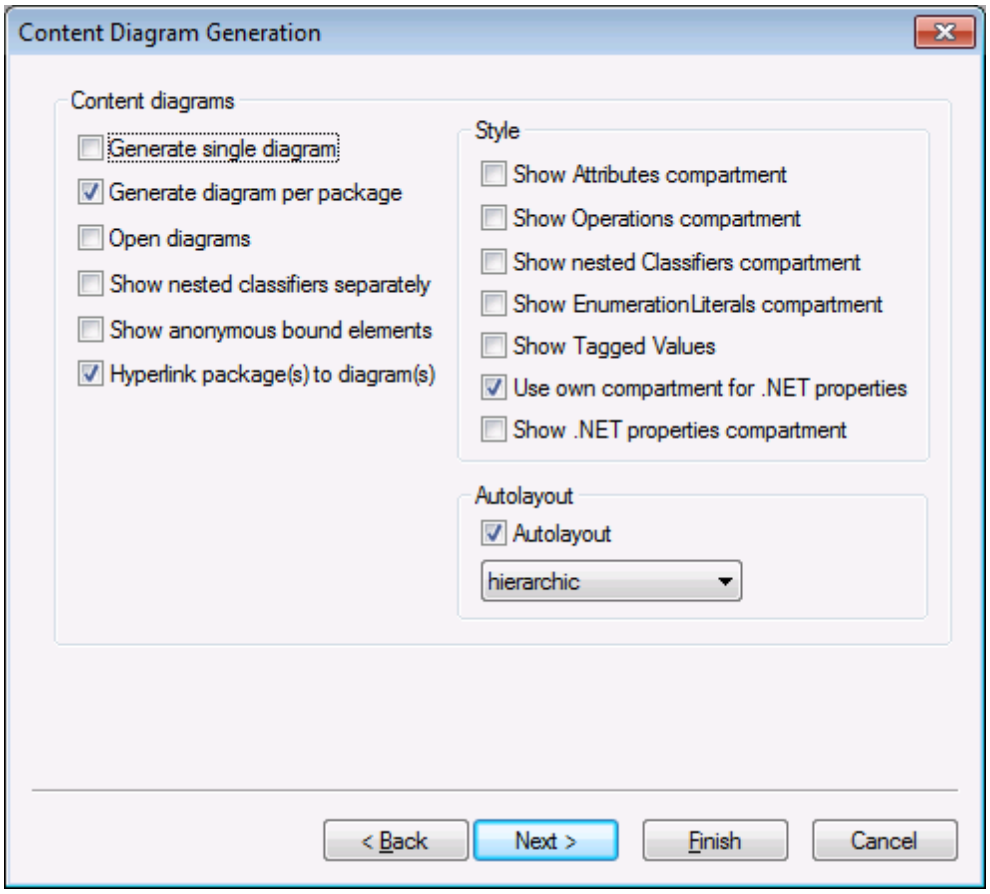
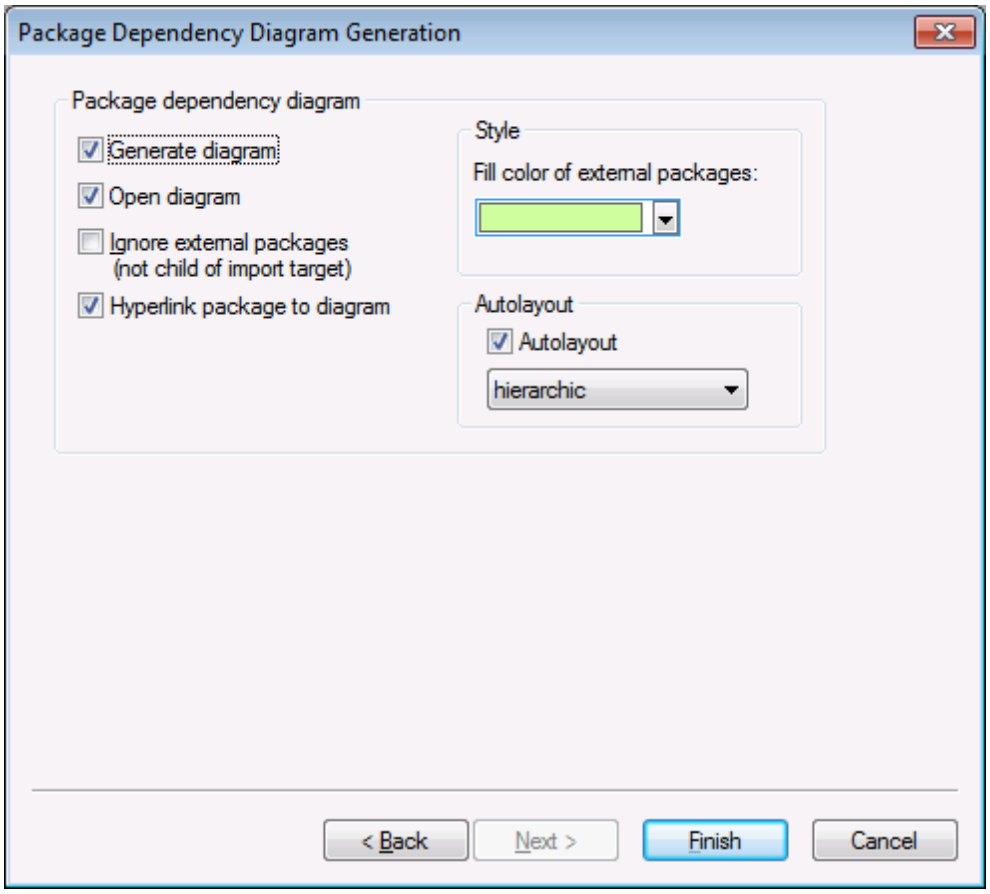
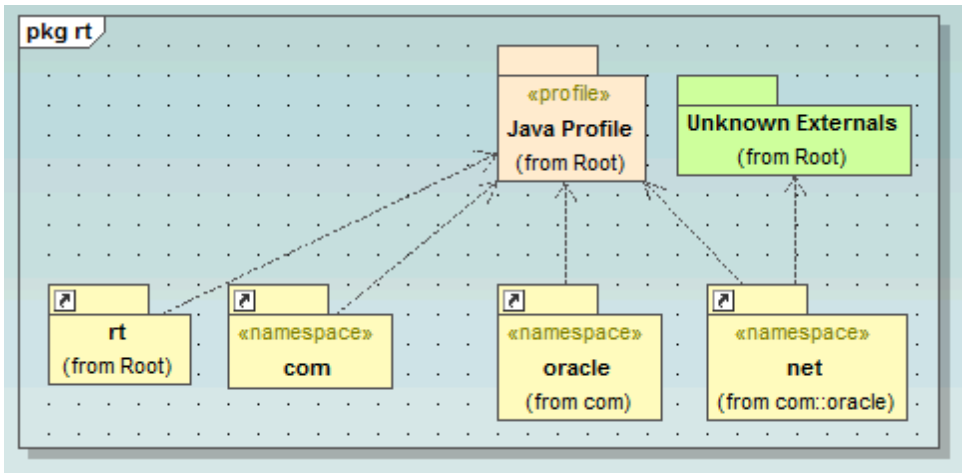


11. Select the Content Diagram Generation properties from the dialog box and click Next to continue. You can generate a diagram for each package, as well as a single overview diagram.



12. Select the Package Dependency options that you would like to include and click Finish to complete the import procedure. The screenshot below shows the diagram containing the package dependencies of the Java binaries.



Note: Clicking the link icon of a folder automatically opens the referenced diagram.

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6.4 Synchronizing the Model and Source Code

You can synchronize the model and code in either direction, and at different levels (for example, project, package or class).

> When UModel (Enterprise or Professional) runs as an Eclipse or Visual Studio plug-in, synchronization between model and code takes place automatically. Manual synchronization is possible at the project level; the option to update individual classes or packages is not available.

When you right-click an element in the Model Tree (for example, a class), the context menu displays the code synchronization or merging commands under the **Code Engineering** menu item:

- **Merge Program Code from UModel *****
- **Merge UModel ***** **from Program Code**

> ***** is a Project, Package, Component, Class, and so on, depending on your current selection.

Depending on the settings you have defined from **Project | Synchronization Settings**, the alternative name of these two commands may be:

- **Overwrite Program Code from UModel *****
- **Overwrite UModel ***** **from Program Code**

To update the entire project (but not classes, packages, or other local elements), you can also use the following commands on the **Project** menu of UModel:

- **Merge (or Overwrite) Program Code from UModel Project**
- **Merge (or Overwrite) UModel Project from Program Code**

For convenience, any of the commands listed above will be generically referred to as "code synchronization commands" further in this topic.

To synchronize at the project or Root package level, do one of the following:

- Right-click the Root package in the Model Tree, and select the required code synchronization command.
- On the **Project** menu, click the required code synchronization command.

To synchronize at package level:

1. Use SHIFT, or CTRL + click to select the package(s) you want to merge.
2. Right-click the selection, and select the required code synchronization command.

To synchronize at class level:

1. Use SHIFT, or CTRL + click to select the classes(s) you want to merge.
2. Right-click the selection, and click the required code synchronization command.

To avoid undesired results when synchronizing the model and code, consider the following scenarios:

On the **Project** menu, click **Overwrite UModel Project from Program Code**.	• This checks all directories (project files) of all different code languages you have defined in your project. • New files are identified and added to the project. • An entry "Collecting source files in (...)" appears in the Messages window.
Right-click a class or interface in the Model Tree and select **Code Engineering | Overwrite UModel Class from Program Code**.	• This updates only the selected class (interface) of your project. • However, if the source code contains classes that are new or modified classes since the last synchronization, those changes will not be added to the model.
Right-click a Component in the Model Tree (within the Component View package) and select **Code Engineering | Overwrite UModel Component from Program Code**.	• This updates the corresponding directory (or project file) only. • New files in the directory (project file) are identified and added to the project. • An entry "Collecting source files in (...)" appears in the Message window.

Note: When synchronizing code, you might be prompted to update your UModel project before synchronization. This occurs when you open UModel projects created before the latest release. Click **Yes** to update your project to the latest release format, and save your project file. The notification message will not occur once this has been done.

Synchronization settings

You can change the synchronization options using the menu command **Project | Synchronization options**.

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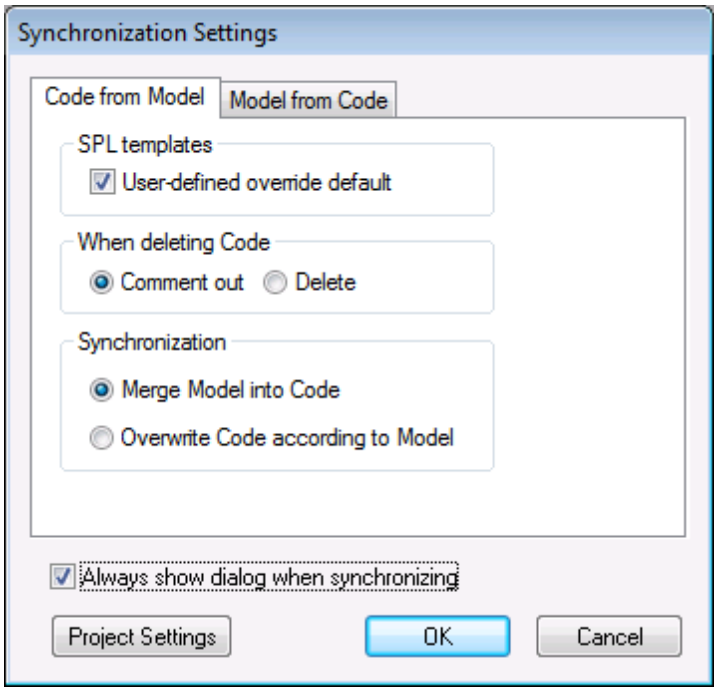

SPL Templates

SPL templates are used during the generation of Java, C# and VB.NET code. SPL templates are only used/accessed when **new** code is generated, i.e. new classes, operations etc. have been added to the model. Existing code does not access/use the SPL templates.

To modify the provided SPL templates:

1. Locate the provided SPL templates in the UModel installation directory ("Program Files"): **...\UModel2016\UModelSPL\Java\Default** (or **...\C#\Default**, **...\VB\Default**.)
2. Copy the SPL files you want to edit/modify into the **parent** directory, i.e. **...\UModel2016\UModelSPL\Java**.
3. Make your changes and save them there.

To use the user-defined SPL templates:

1. Select the menu option **Project | Synchronization settings**.
2. Select the **User-defined override default** check box in the SPL templates group.

6.4.1 Synchronization Tips

Renaming of classifiers and reverse engineering

The process described below applies to the standalone application as well as to the plug-in versions (Visual Studio or Eclipse) when reverse engineering or automatic synchronization takes place.

Renaming a classifier in the code window of your programming application causes it to be deleted and re-inserted as new classifier in the **Model Tree**.

The new classifier is only re-inserted in those modeling diagrams that are automatically created during the reverse-engineering process, or when generating a diagram using the **Show in new Diagram | Content** option. The new classifier is inserted at a default position on the diagram, that will likely differ from the previous location.

See also Refactoring code and synchronization.

Automatic generation of ComponentRealizations

UModel is capable of automatically generating ComponentRealizations during the code engineering process. ComponentRealizations are only generated where it is absolutely clear to which component a class should be assigned:

- Only one Visual Studio project file exists in the .ump project.
- Multiple Visual Studio projects exist but their classes are completely separate in the model.

To enable automatic generation of ComponentRealizations:

1. Open the menu item **Tool | Options**.
2. Click the **Code Engineering** tab and activate the **Generate missing ComponentRealizations** option.

Automatic ComponentRealizations are created for a **Classifier** that can be assigned one (and only one) Component

- without any ComponentRealizations, or
- contained in a code language namespace.

The way the Component is found differs for the two cases.

Component representing a code project file (property "**projectfile**" set)

- if there is ONE Component having/realizing classifiers in the containing package
- if there is ONE Component having/realizing classifiers in a subpackage of the containing package (top down)
- if there is ONE Component having/realizing classifiers in one of the the parent packages (bottom up)
- if there is ONE Component having/realizing classifiers in a subpackage of one of the the parent packages (top down)

Component representing a directory (property "**directory**" set)

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- if there is ONE Component having/realizing classifiers in the containing package
- if there is ONE Component having/realizing classifiers in one of the the parent packages (bottom up)

Notes:

- The option "**Code Engineering | Generate missing ComponentRealizations**" has to be set.
- As soon as ONE viable Component is found during one of the above steps, this Component is used and the remaining steps are ignored.

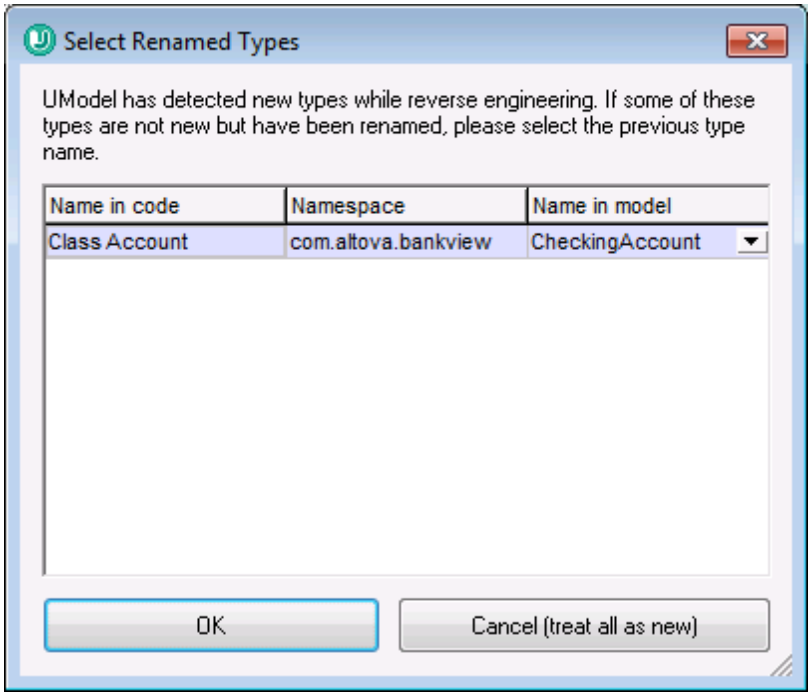
Error/Warnings:

- If no viable Component was found, a warning is generated (message log)
- If more than one viable Component was found, an error is generated (message log)

6.4.2 Refactoring Code and Synchronization

When refactoring code it is often the case that class names are changed/updated. Versions of UModel prior to version 2009 deleted the "old" classes and inserted new ones, during the code/ model synchronzation process.

UModel 2009 or later displays a dialog box if it detects that new types have been added/renamed during reverse engineering. The new types are listed in the "Name in code" column while the assumed original type name is listed in the "Name in model" column. UModel attempts to determine the original name by relying on namespace, class content, base classes and other data.


Select Renamed Types
UModel has detected new types while reverse engineering. If some of these types are not new but have been renamed, please select the previous type name.
Name in code
Namespace
Name in model
Class Account
com.altova.bankview
CheckingAccount
OK
Cancel (treat all as new)

If a class was renamed, select the previous class name using the combo box in the "Name in model" column, e.g. C1. This ensures that all related data are retained and and the code engineering process remains accurate.

Changing class names in the model and regenerating code

Having created a model and generated code from it, it is possible that you might want to make changes to the model again before going through the synchronization process.

E.g. You decide that you want to change the class names before generating code the second time round. As you previously assigned a file name to each class, in the "code file name" field of the Properties window, the new class and file name would now be out of sync.

UModel prompts if you want the code file name to agree with the new class name, when you start the synchronization process. Note that you also have the option to change the class constructors as well.

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Round-trip engineering and relationships between modeling elements

When updating model from code, associations between modeling elements are automatically displayed, if the option **Diagram Editing | Automatically create Associations** has been activated in the **Tools | Options** dialog box. Associations are displayed for those elements where the attributes type is set, and the referenced "type" modeling element is in the same diagram.

InterfaceRealizations as well as Generalizations are all automatically shown in the diagram when updating model from code.

6.5 Forward engineering prerequisites

Minimum conditions needed to produce code for forward engineering:

- A component must be **realized** by one or more **classes**, or **interfaces**.
- The component must have a **physical location**, i.e. directory, assigned to it. The generated code is then placed in this directory.
- Components must be individually set to be **included** in the code engineering process.
- The Java, C#, or VB namespace root package must be defined.

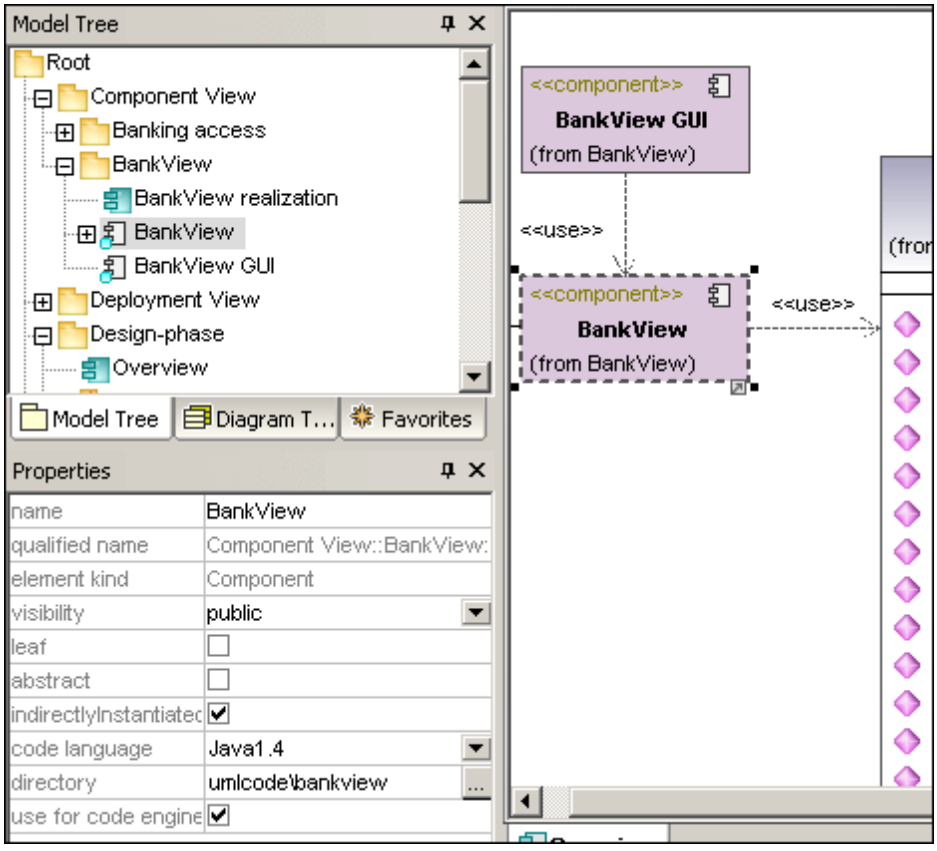
To create a component realization:

1. Drag the class, or interface onto the respective component in the Model Tree view.

   You can also create a realization in a component diagram using the Realization icon.

To assign a physical location:

1. Select the component in the Model Tree, or in the diagram.
2. Click the Browse button ... of the **directory** property and select a directory (or enter it directly).



To include components in the code engineering process:

1. Select the component in the Model Tree, or in the diagram.
2. Activate the "**use for code engineering**" check box.

To define the Java namespace root:

1. Right clicking a package and selecting "Set as Java namespace root" sets the Java namespace root.

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This means that this package and all sub packages, are enabled during the code engineering process. The Java namespace root is denoted with a icon in the Model Tree pane.

- Selecting the command again **removes** the Java namespace for this package.

6.6 Java code to/from UModel elements

The table below shows the one-to-one correspondence between:

- UModel elements and Java code elements, when outputting model to code
- Java code elements and UModel model elements, when inputting code into model

The screenshot shows a small section of the table. Please click HERE to open the HTML version of the table in your browser.

Java ◁▷ UModel					
Java			UModel		
Project	projectfile directory		projectfile directory		Component
Package	name		name		Package <<namespace>>
	name		name		
	modifiers	package	visibility	package	
		public		public	
		protected		protected	
		private		private	
		abstract	abstract		
		final	isFinalSpecification		
		strictfp	<<strictfp>>		
	filename		code file name		
	associated projectfile/directory		ComponentRealization		
	extends clause		Generalization		
	implements clause		InterfaceRealization(s)		
	java docs		Comment(->Documentation)		

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6.7 C# code to/from UModel elements

The table below shows the one-to-one correspondence between:

- UModel elements and C# code elements, when outputting model to code
- C# code elements and UModel model elements, when inputting code into model

The screenshot shows a small section of the table. Please click HERE to open the HTML version of the table in your browser.

C# ◁▷ UModel					
C#			UModel		
Project	projectfile		projectfile		Component
	directory		directory		
Namespace	name		name		Package <<namespace>>
	name		name		
	modifiers	internal	visibility	package	
		protected internal		protected <<internal>>	
		public		public	
		protected		protected	
		private		private	
		sealed	isFinalSpecification		
		abstract	abstract		
		static	<<static>>		
		unsafe	<<unsafe>>		
		partial	<<partial>>		
		new	<<new>>		
	filename		code file name		
	associated projectfile/directory		ComponentRealization		
	base types		Generalization, InterfaceRealization(s)		
	attribute sections		<<attributes>>		
	doc comments		Comment(->Documentation)		

6.8 XML Schema to/from UModel elements

The table below shows the one-to-one correspondence between:

- UModel elements and XML Schema elements, when outputting model to code
- XML Schema elements and UModel model elements, when inputting code into model

XSD/UML Element

Stereotype property (=tagged value)

The screenshot shows a small section of the table. Please click HERE to open the HTML version of the table in your browser.

XSD ◁▷ UModel						
XSD				UModel		
file path				project file		Component
	target namespace			name		Package <<namespace>>
	attributeFormDefault			attributeFormDefault		
	blockDefault			blockDefault		
	elementFormDefault			elementFormDefault		
	finalDefault			finalDefault		
	version			version		
	xml:lang			xml:lang		
	xmlns			xmlns		
	annotation	source		source		
		appinfo			Comment <<appinfo>>	
		documentation	xml:lang	xml:lang	Comment <<documentation>>	

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6.9 VB.NET code to/from UModel elements

The table below shows the one-to-one correspondence between:

- UModel elements and VB.NET code elements, when outputting model to code
- VB.NET code elements and UModel model elements, when inputting code into model

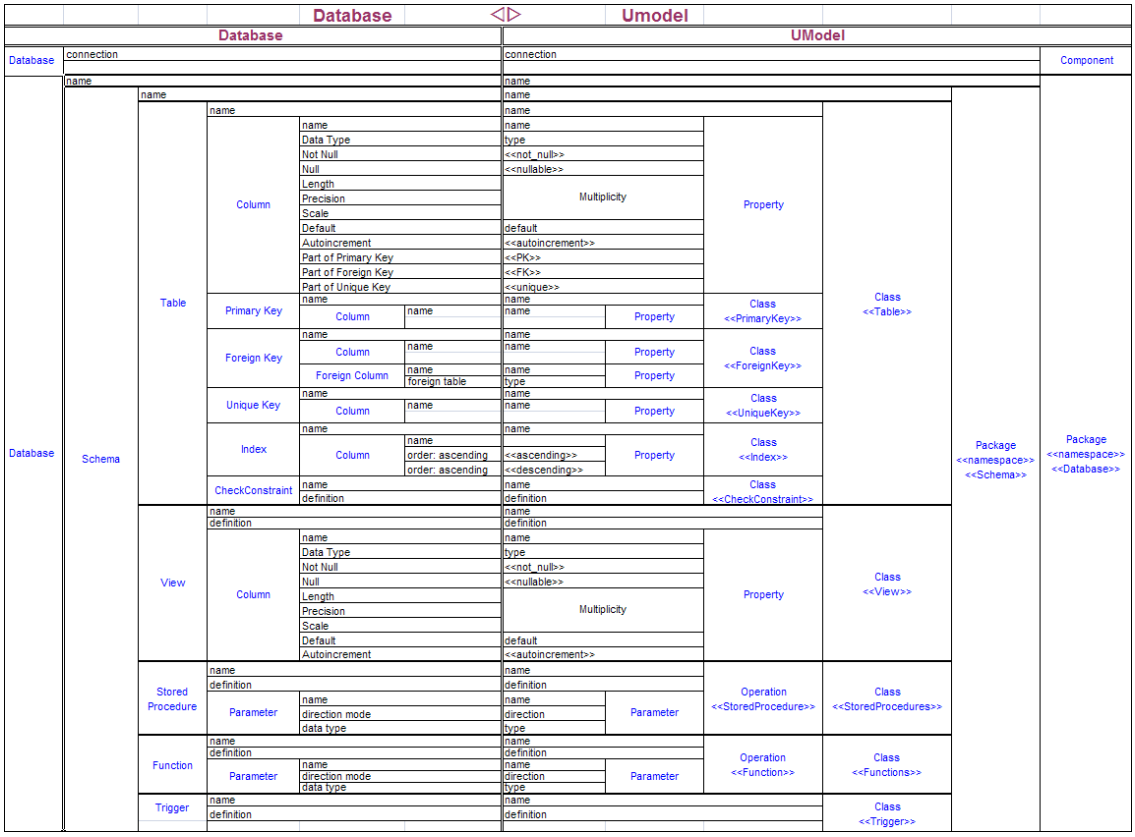
The screenshot shows a small section of the table. Please click HERE to open the HTML version of the table in your browser.

<table>
<tr><th colspan="5">VB.NET ◁▷ UModel</th></tr>
<tr><th colspan="3">VB.NET</th><th colspan="2">UModel</th></tr>
<tr><td>Project</td><td colspan="2">projectfile
directory</td><td colspan="2">projectfile
directory</td><td>Component</td></tr>
<tr><td>Namespace</td><td colspan="2">name</td><td colspan="2">name</td><td>Package
<<namespace>></td></tr>
<tr><td rowspan="13"></td><td colspan="2">name</td><td colspan="2">name</td><td rowspan="13"></td></tr>
<tr><td rowspan="8">modifiers</td><td>Friend</td><td rowspan="5">visibility</td><td>package</td></tr>
<tr><td>Protected Friend</td><td>protected <<Friend>></td></tr>
<tr><td>Public</td><td>public</td></tr>
<tr><td>Protected</td><td>protected</td></tr>
<tr><td>Private</td><td>private</td></tr>
<tr><td>NotInheritable</td><td colspan="2">isFinalSpecification</td></tr>
<tr><td>MustInherit</td><td colspan="2">abstract</td></tr>
<tr><td>Partial</td><td colspan="2"><<Partial>></td></tr>
<tr><td>Shadows</td><td colspan="2"><<Shadows>></td></tr>
<tr><td colspan="2">filename</td><td colspan="2">code file name</td></tr>
<tr><td colspan="2">associated projectfile/directory</td><td colspan="2">ComponentRealization</td></tr>
<tr><td colspan="2">base types</td><td colspan="2">Generalization, InterfaceRealization(s)</td></tr>
<tr><td colspan="2">attribute sections</td><td colspan="2"><<Attributes>></td></tr>
<tr><td colspan="2">doc comments</td><td colspan="2">Comment(->Documentation)</td></tr>
</table>

6.10 Database to/from UModel elements

The table below shows the one-to-one correspondence between:

- UModel elements and database elements, when outputting model to code
- Database elements and UModel model elements, when inputting code into model



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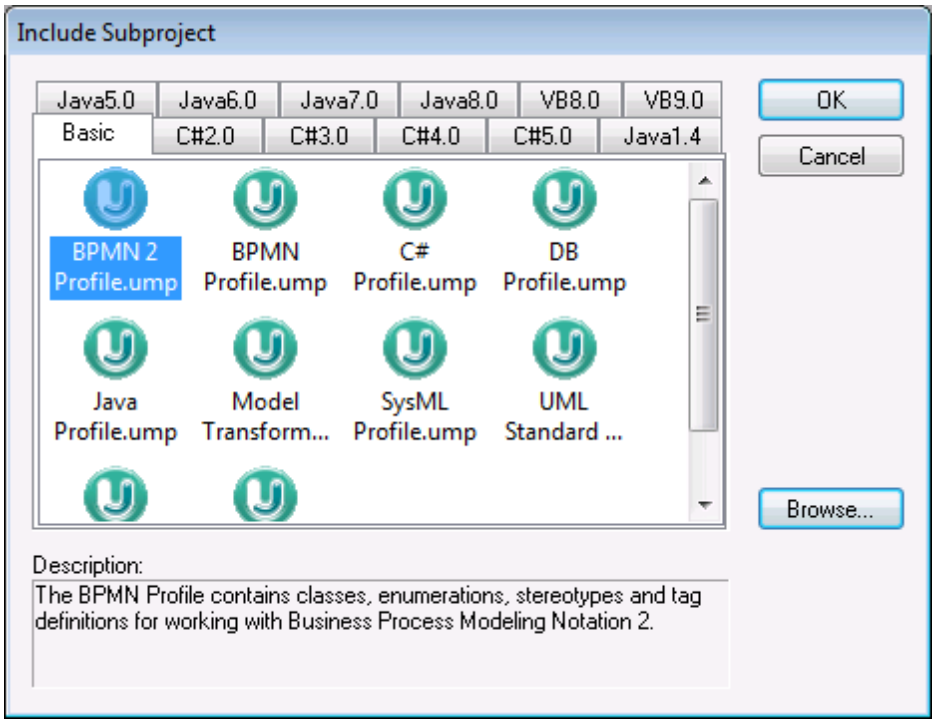
6.11 Including other UModel projects

To include a UModel project as a subproject of another UModel project, select the menu command **Project | Include Subproject**.



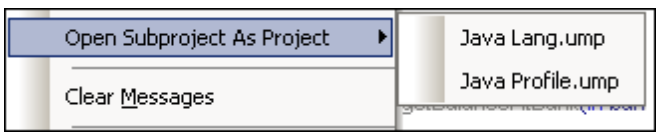
Include Subproject dialog box

The tabs and UModel projects (.ump files) available on the "Include Subproject" dialog box are configurable. Namely, UModel reads this information from the following path relative to the "Program Files" folder on your operating system: **\Altova\UModel2016\UModelInclude**. Note that the project files available on the **Basic** tab exist directly under the **UModelInclude** folder, while projects in each of the Java, VB, and C# tabs exist as subfolders of the **UModelInclude** folder.

By default, UModel is supplied with several project profiles (.ump files) that can be useful in your UModel project. For example, Java lang classes, interfaces and packages are available on the Java tabs, organized by Java version. Likewise, .ump files for the Microsoft C# and VB types are available on separate tabs organized by version.

To view all currently imported projects:

- Select the menu option **Project | Open Subproject Individually**. The context menu displays the currently included subprojects.



To create a custom tab on the "Include Subproject" dialog box:

- Navigate to the **\Altova\UModel2016\UModelInclude** folder (relative to your "Program Files"), and create your custom folder in it, for example **\UModelInclude\myfolder**. The name you give to the folder determines the name of the tab on the "Include Subproject" dialog box.
- Copy to your custom folder any .ump files that you want to make available on the corresponding tab.

To create descriptive text for each UModel project file:

- Create a text file using the same name as the *.ump file and place in the same folder. For example, the **MyModel.ump** file requires a descriptive file called **MyModel.txt.** Please make sure that the encoding of this text file is UTF-8.

To remove an included project:

1. Click the included package in the Model Tree view and press the **Delete** key.
2. You are prompted if you want to continue the deletion process.
3. Click OK to delete the included file from the project.

To delete or remove a project from the "Include Subproject" dialog box:

- Delete or remove the (MyModel).ump file from the respective folder.

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6.12 Merging UModel projects

It is now possible to perform a 2-way, or 3-way, project merge in UModel. Both merge different UModel project files into a common UModel *.ump model.

This option is useful if multiple persons are working on the same project at the same time, or you just want to consolidate your work into one model.

Please see:

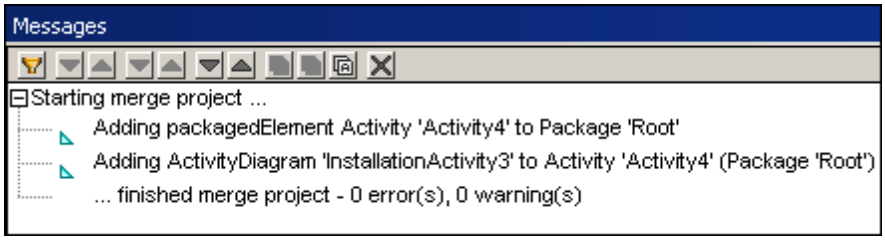
2-way Project merge

3-way Project merge

6.12.1 2-way Project merge

To merge two UML projects:

1. Open the UML file that is to be the target of the merge process, i.e. the file into which the second model will be merged - the merged project file.
2. Select the menu option **Project | Merge Project...**
3. Select the **second** UML project that is to be merged into the first one.
   The message window reports on the merge process, and logs the relevant details.


Messages
Starting merge project ...
Adding packagedElement Activity 'Activity4' to Package 'Root'
Adding ActivityDiagram 'InstallationActivity3' to Activity 'Activity4' (Package 'Root')
... finished merge project - 0 error(s), 0 warning(s)

Please note:

Clicking on one of the entries in the message window displays that modeling element in the Model Tree.

Merging results:

- **New** modeling elements i.e. those that do not exist in the source, are added to the merged model.
- **Differences** in the same modeling elements; the elements from the **second** model take precedence, e.g. there can only be one default value of an attribute, the default value of the second file is used.
- **Diagram** differences: UModel first checks to see if there are differences between diagrams of the two models.

  If there are, then the new/different diagram is added to the merged model (with a running number suffix, activity1 etc.) and the original diagram is retained.

  If there are no differences, then identical diagrams(s) are ignored, and nothing is changed.

  You can then decide which of the diagrams you want to keep or delete, you can of course keep both of them if you want.

- The whole merge process can be **undone** step-by-step by clicking the Undo icon in the icon bar, or pressing CTRL+Z.
- Clicking an entry in the message window displays that element in the Model Tree.
- The **file name** of the merged file, the first file you opened, is retained!

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6.12.2 3-way Project merge

UModel now supports the merging of multiple UModel projects that have been simultaneously edited by different developers, in a 3-way project merge.

Project merging

The 3-way project merge works with **top-level** UModel projects, i.e. main projects that may contain subprojects, it does not support individual **file** merging, when these files have unresolved references to other files.

When merging **main** projects, any editable subprojects are automatically merged as well. There is no need for a separate subproject merging process.

Please see Manual 3-way project merge example for a simple example.

- The whole merge process can be **undone** step-by-step by clicking the Undo icon in the icon bar, or pressing CTRL+Z.
- Clicking an entry in the message window displays that element in the Model Tree.
- The **file name** of the merged file, the first file you opened, is retained!

Merging results:

Note: ***source*** in the following text, means the initial/first project file you open before starting the merge process.

- **New** modeling elements in the second file i.e. that do not exist in the source, are added to the merged model.
- New modeling elements in the source file i.e. that do not exist in the second file, remain in the merged model.
- **Deleted** modeling elements from the second file i.e. those that still exist in the source, are removed from the merged model.
- Deleted modeling elements from the source file i.e. that still exist in the second file, remain deleted from the merged model.

Differences to the **same** modeling elements:

- If a property (e.g. the visibility of a class) is changed in either the source, **or** second file, the updated value is used in the merged model
- If a property (e.g. the visibility of a class) is changed in both source **and** second file, the value of the second file is used (and a warning is shown in the messages window)

Moved elements:

- If an element is moved in the source, **or** second file, then the element is moved in the merged model
- If an element is moved (to different parents) in **both** the source and second file, a prompt appears, and you have to manually select the parent element in the merged model

Diagram differences:
UModel first checks to see if there are differences between diagrams of the two models.

If there are, then the new/different diagram is added to the merged model (with a running number suffix, activity1 etc.) and the original diagram is retained.

If there are no differences, then identical diagrams(s) are ignored, and nothing is changed.

You can then decide which of the diagrams you want to keep or delete, you can of course keep both of them if you want.

Source control systems support for 3-way merging

When checking in/out project files, UModel automatically generates "Common ancestor" (or snapshot) files which are then used for the 3-way merge process. This enables a much finer merge result than the normal 2-way merge.

The specific source control system you use, determines if the **automatic** snapshot 3-way merge process is supported by UModel. A manual 3-way merge is however, always possible.

- Source control systems that perform automatic file merging without user intervention, will probably not support an automatic 3-way merge.
- Source control systems that prompt you to choose between Replace or Merge, when a project file has been changed, will generally support a 3-way merge. After the source control plugin has replaced the file, selecting the Replace command activates the UModel file alert which then allows you to do a 3-way merge. UModel must be used for the check in/out process.
- Main projects as well as subprojects can be placed under source control. Changing data in a subproject automatically prompts you if the subproject(s) should be checked out.
- Each check in/out action, creates a Common ancestor, or a snapshot, file which is then used during the 3-way project merge process.

Please note:

Snapshot files are only automatically created and used with the standalone versions of UModel, i.e. these functions are not available in the Eclipse or Visual Studio plugin versions.

E.g.
User A edits a UModel project file and changes the name of a class in the BankView Main diagram. User B opens the same project file and changes the visibility of the same class.

As snapshot files are created for each user, the snapshot editing history allows the individual changes to be merged into the project. Both the name and visibility changes are merged into the project file during the 3-way merge process.

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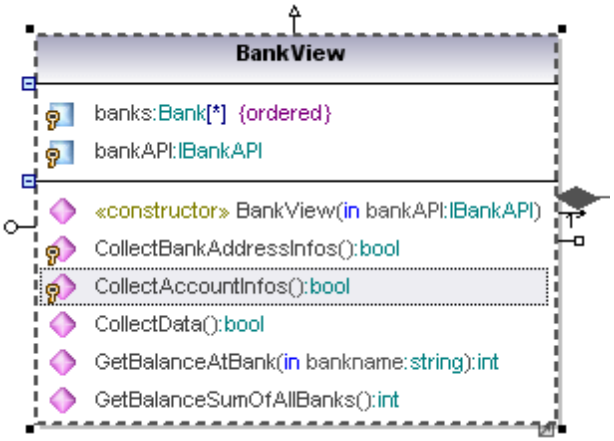
6.12.3 Manual 3-way project merge example

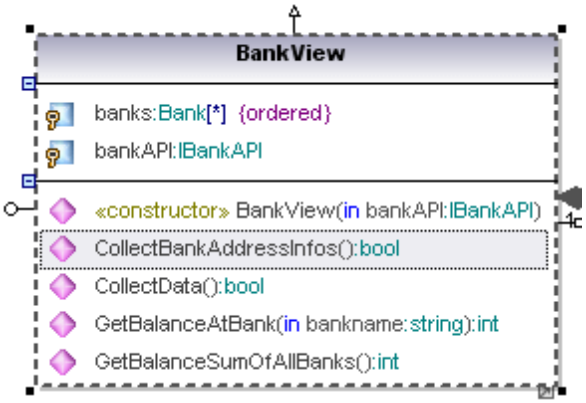
This simple example uses the **Bank_CSharp.ump** file available in the ...\UModelExamples folder. Two other instances of the same project are copied to child folders below the UmodelExamples folder, i.e. \C#_1 and \C#_2.

User1 opens the Bank_CSharp.ump project file in folder **C#_1** and makes changes to the **BankView** class.



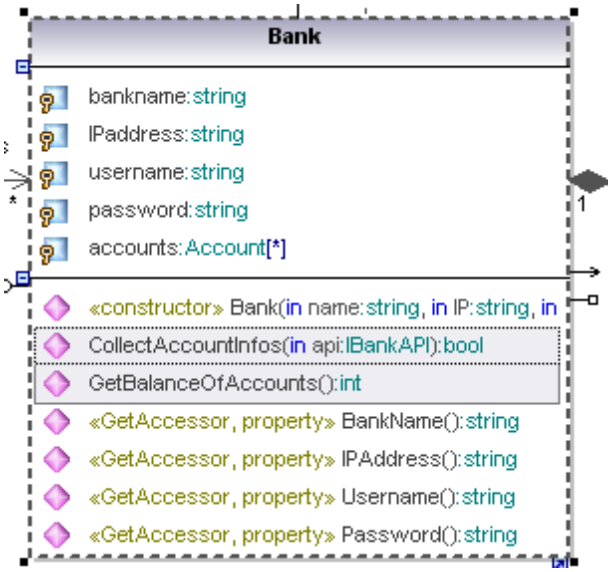
Changes made to the BankView class:

1. Operation **CollectAccountInfos():bool** is **deleted** from the BankView class.
2. The **visibility** of the **CollectBankAddressInfos():bool** operation is changed from "protected" to "public".



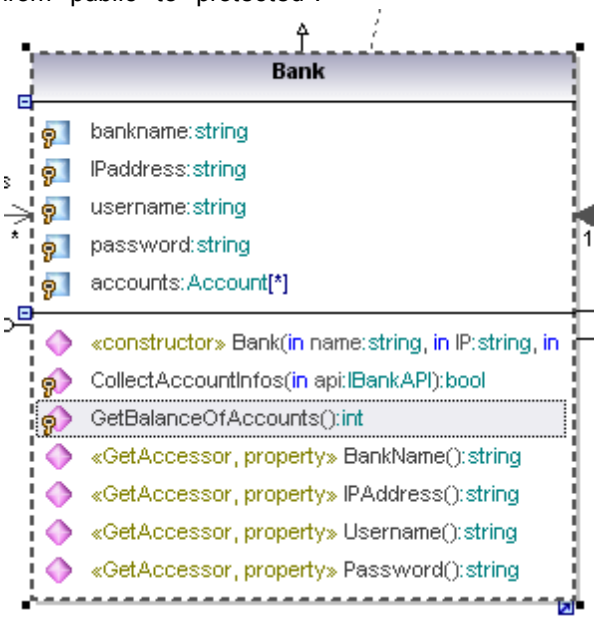
3. The project is then saved.

User2 opens the **Bank_CSharp.ump** project file in folder **C#_2** and makes changes to the **Bank** class.



Changes made to the Bank class:

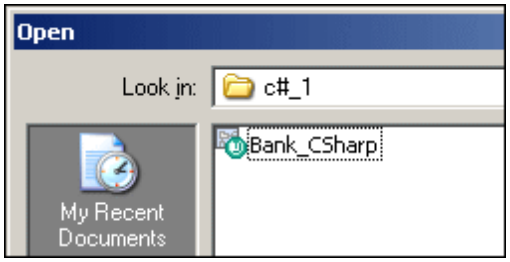
1. The operations **CollectAccountInfos**... and **GetBalanceOfAccounts**... are both changed from "public" to "protected".



2. The project is then saved.

Usr2 now starts a **3-way project merge:**

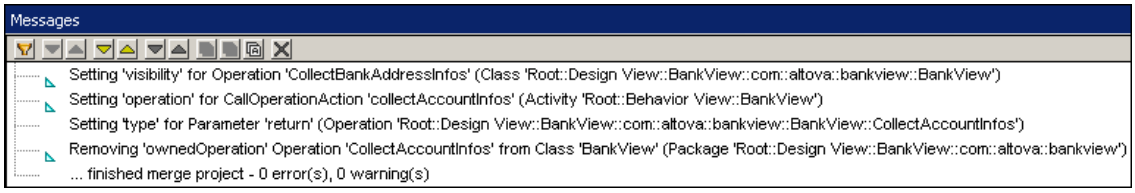
1. Select **Project | Merge Project (3-way)**.
   The Open file dialog box appears.
2. Select the project file changed by **User1** in the ...\C#_1 folder.



You are now prompted to open the **Common Ancestor file**, which is the original project file in the ...\UModelExamples folder.

The 3-way merge process is started and you return to the project file from which you started the 3-way merge process, i.e. from the project file in the C#_2 folder.

The Messages window shows you the merge process in detail.


Messages
Setting 'visibility' for Operation 'CollectBankAddressInfos' (Class 'Root::Design View::BankView::com::altova::bankview::BankView')
Setting 'operation' for CallOperationAction 'collectAccountInfos' (Activity 'Root::Behavior View::BankView')
Setting 'type' for Parameter 'return' (Operation 'Root::Design View::BankView::com::altova::bankview::BankView::CollectAccountInfos')
Removing 'ownedOperation' Operation 'CollectAccountInfos' from Class 'BankView' (Package 'Root::Design View::BankView::com::altova::bankview')
... finished merge project - 0 error(s), 0 warning(s)

- The changes made to the project in the C#_1 folder, are replicated in the C#_2 project file.
- The changes made to the project in the C#_2 folder, are retained in the project file.
- The project file in the C#_2 folder should now be used as the Common Ancestor file for future 3-way merges between the project files in folders C#_1 and C#_2.

6.13 Sharing Packages and Diagrams

UModel allows you to share packages and UML diagrams they might contain, between different projects. Packages can be included in other UModel projects by reference, or as a copy.

Also note that subproject files can be split off a main, or subproject, file at any time. The subproject files can be included as editable or read-only from the main project; each package is shared and saved as a subproject file. Subprojects can be added to a source control system. Please see Teamwork support for UModel projects for more information.

Shared package prerequisites:

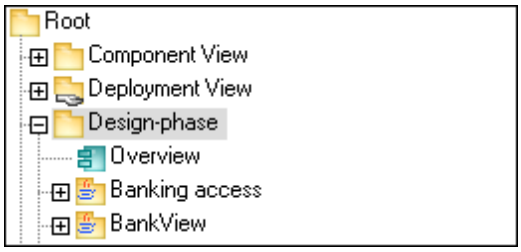
- Links to other packages outside of the shared scope are not permissible.

Note:

When creating UModel project files, do not use one project file as a "template/copy" for a another project file into which you intend to share a package. This will cause conflicts due to the fact that every element should be globally unique (see uuid) and this will not be the case, as two projects will have elements that have identical uuids.

To share a package between projects:

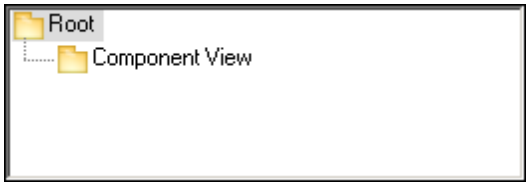
1. Right click a package in the Model Tree tab and select **Subproject | Share package**.



A "shared" icon appears below the shared package in the Model Tree. This package can now be included in any other UModel project.

To include/import a shared folder in a project:

1. Open the project which should contain the shared package (an empty project in this example).



2. Select the menu item **Project | Include Subproject...**
3. Click the Browse button, select the project that contains the shared package and click Open.

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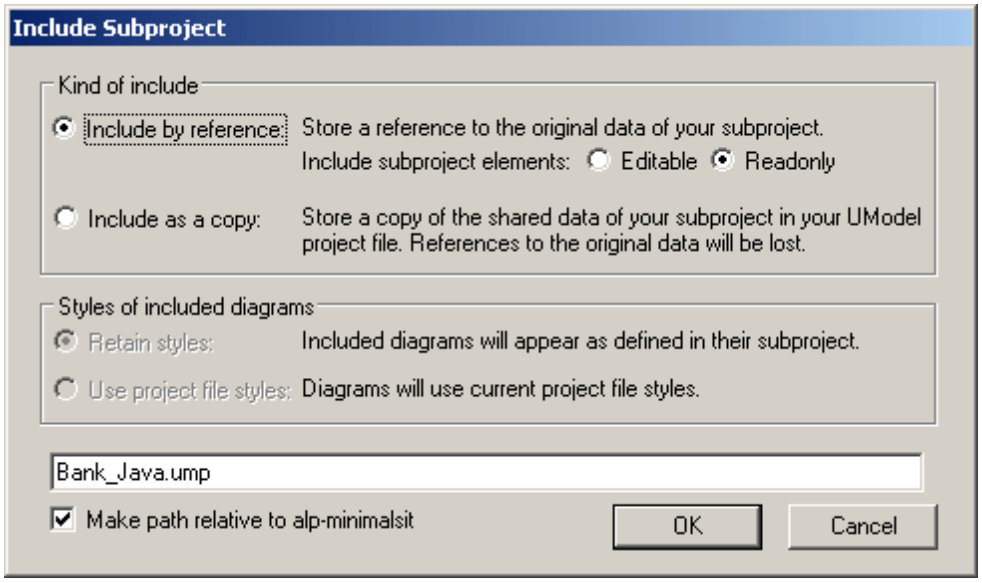
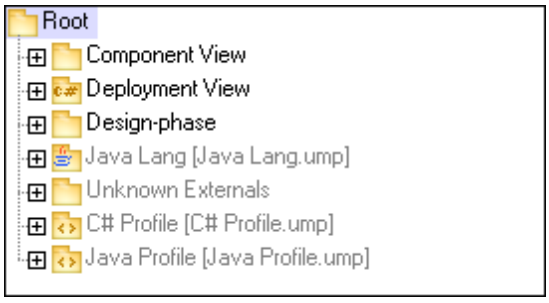

Include Subproject
Kind of include
Include by reference:
Store a reference to the original data of your subproject.
Include subproject elements:
Editable
Readonly
Include as a copy:
Store a copy of the shared data of your subproject in your UModel project file. References to the original data will be lost.
Styles of included diagrams
Retain styles:
Included diagrams will appear as defined in their subproject.
Use project file styles:
Diagrams will use current project file styles.
Bank_Java.ump
Make path relative to alp-minimalsit
OK
Cancel

The "Include" dialog box allows you to choose between including the package/project by reference, or as a copy.

4. Select the specific option (Include by reference) and click OK.



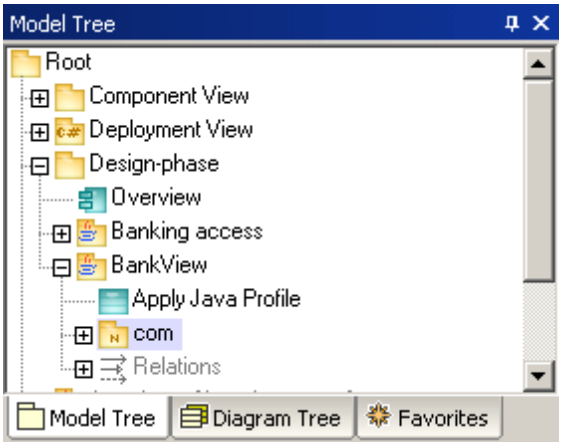
The "Deployment View" package is now visible in the new package. The packages' source project is displayed in parenthesis (BankView-start.ump).

Shared folders that have been included by reference can be changed to "Include by copy" at any time, by right clicking the folder and selecting **Subproject | Include as a Copy**.

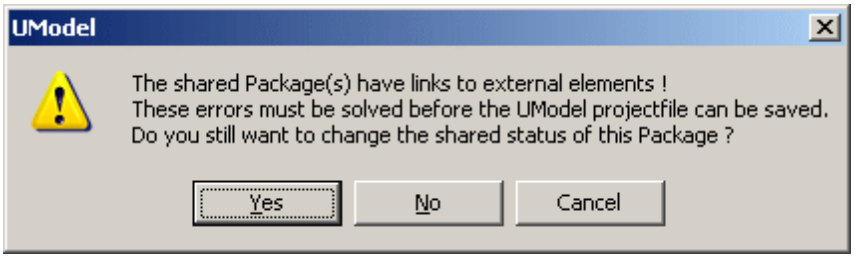
Please note:

All included projects of the source project, have also been included: Java Lang, Unknown Externals and Java Profile.

Shared packages - links to external elements:

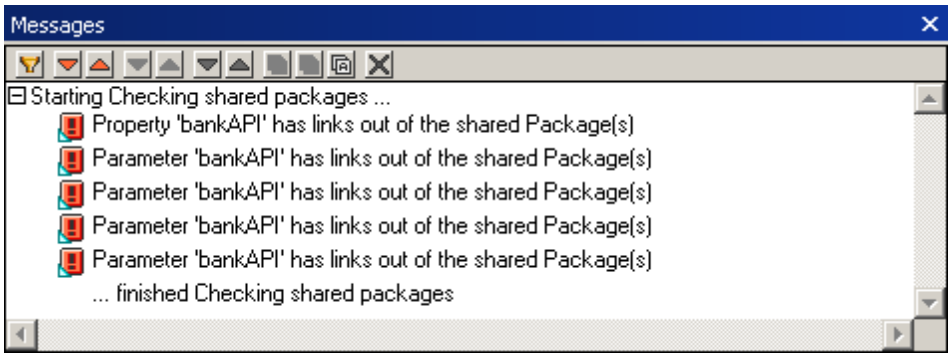


Attempting to share a package which has links to external elements causes a prompt to appear. E.g. trying to share the BankView package.

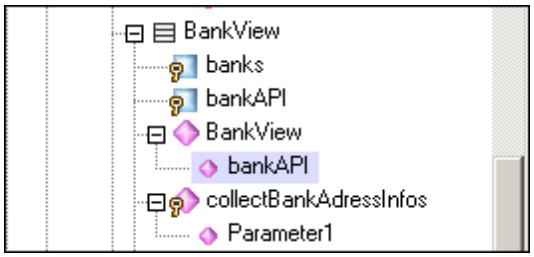

UModel
The shared Package(s) have links to external elements !
These errors must be solved before the UModel projectfile can be saved.
Do you still want to change the shared status of this Package ?
Yes
No
Cancel

Clicking Yes, forces you to resolve the external links before you can save.

The Messages pane provides information on each of the external links.


Messages
Starting Checking shared packages ...
Property 'bankAPI' has links out of the shared Package(s)
Parameter 'bankAPI' has links out of the shared Package(s)
Parameter 'bankAPI' has links out of the shared Package(s)
Parameter 'bankAPI' has links out of the shared Package(s)
Parameter 'bankAPI' has links out of the shared Package(s)
... finished Checking shared packages

Clicking an error entry, in the Messages pane, displays the relevant element in the Model Tree tab.



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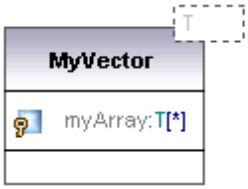
6.14 UML templates

UModel supports the use of UML templates and their mapping to or from Java, C# and Visual Basic generics.

- Templates are "potential" model elements with unbound formal parameters.
- These parameterized model elements, describe a group of model elements of a particular type: classifiers, or operations.
- Templates cannot be used directly as types, the parameters have to be bound.
- Instantiate means binding the template parameters to actual values.
- Actual values for parameters are expressions.
- The binding between a template and model element, produces a new model element (a bound element) based on the template.
- If multiple constraining classifiers exist in C#, then the template parameters can be directly edited in the Properties tab, when the template parameter is selected.

Template **signature** display in UModel:



- Class template called **MyVector**, with formal template parameter "**T**", visible in the dashed rectangle.
- Formal parameters without type info (T) are implicitly classifiers: Class, Datatype, Enumeration, PrimitiveType, Interface. All other parameter types must be shown explicitly e.g. Integer.
- Property **myArray** with unbounded number of elements of type T.

  Right clicking the template and selecting **Show | Bound elements**, displays the actual bound elements.

Template **binding** display:

- A bound named template **intvector**
- Template of type, **MyVector**, where
- Parameter **T** is substituted/replaced by **int.**
- **"Substituted by"** is shown by **->**.

Template use in properties/operations:

An anonymous template binding:

- Property MyFloatVector of type **MyVector<T->float>**

Templates can also be defined when defining properties or operations. The autocomplete function helps you with the correct syntax when doing this.

- Operation1 returns a vector of floats.

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6.14.1 Template signatures

A Template signature is a string that specifies the formal template parameters. A template is a parameterized element that is used to generate new model elements by substituting/binding the formal parameters to actual parameters (values).

Formal template parameter

T
Template with a single untyped formal parameter
(stores elements of type T)

Multiple formal template parameters

KeyType:DateType, ValueType

Parameter substitution

T>aBaseClass

The parameter substitution must be of type "aBaseClass", or derived from it.

Default values for template parameters

T=aDefaultValue

Substituting classifiers

T>{contract}aBaseClass

allowsSubstitutable is true
Parameter must be a classifier that may be substituted for the classifier designated by the classifier name.

Constraining template parameters

T:Interface>anInterface

When constraining to anything other than a class, (interface, datatype), the constraint is displayed after the colon ":" character. E.g. T is constrained to an interface (T:Interface) which must be of type "anInterface" (>anInterface).

Using wildcards in template signatures

T>vector<T->?<aBaseClass>

Template parameter T must be of type "vector" which contains objects which are a supertype of aBaseClass.

Extending template parameters

T>Comparable<T->T>

6.14.2 Template binding

Template binding involves the substitution of the formal parameters by actual values, i.e. the template is instantiated. UModel automatically generates anonymously bound classes, when this binding occurs. Bindings can be defined in the class name field as shown below.

Substituting/binding formal parameters

vector <T->int>

Create bindings using the class name

a_float_vector:vector<T->float>

Binding multiple templates simultaneously

Class5:vector<T->int, map<KeyType->int, ValueType<T->int>

Using wildcards ? as parameters (Java 5.0)

vector<T->?>

Constraining wildcards - upper bounds (UModel extension)

vector<T->?>aBaseClass>

Constraining wildcards - lower bounds (UModel extension)

vector<T->?<aDerivedClass>

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6.14.3 Template usage in operations and properties

Operation returning a bound template

Class1
Operation1():vector<T->int>

Parameter T is bound to "int". Operation1 returns a vector of ints.

Class containing a template operation

Class1
Operation1<T>(in T):T

Using wildcards

Class1
Property1:vector<T->?>

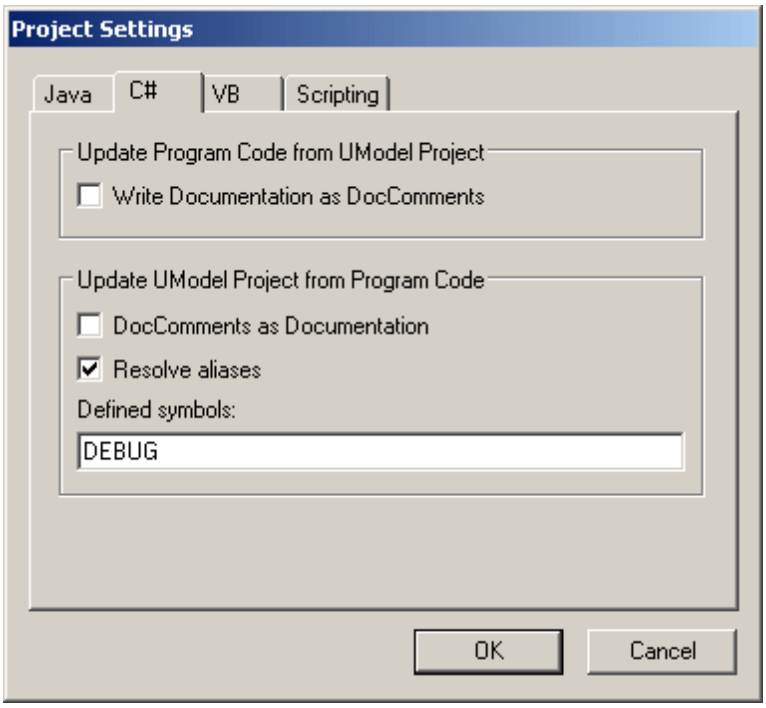
This class contains a generic vector of unspecified type (? is the wildcard).

Typed properties can be displayed as associations:

- Right click a property and select **Show | PropertyX as Association**, or
- Drag a property onto the diagram background.

6.15 Project Settings

This option allows you to define the global project settings.



Select the menu item **Tools | Options** to define your local settings, please see **Tools | Options** in the Reference section for more details on the local settings.

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6.16 Enhancing performance

Due to the fact that some modeling projects can become quite large, there are a few ways you can enhance the modeling performance:

- Make sure that you are using the latest driver for your specific graphics card (resolve this before addressing the following tips)
- Disable syntax coloring - **Styles tab | Use Syntax Coloring** = false.
- Disable "gradient" as a background color for diagrams, use a solid color. E.g. **Styles tab | Diagram background color | White.**
- The automatically enabled autocompletion can be deactivated using **Tools | Options | Diagram Editing** then unchecking the "Enable automatic entry helper" check box.

Chapter 7

Creating model relationships

7 Creating model relationships

Model relationships can be created and inserted into diagrams using several methods:

- By using the connection handles, please see Use cases for an example.
- By clicking the specific icon in the icon bar, and using drag-and-drop to create the connections between the elements:

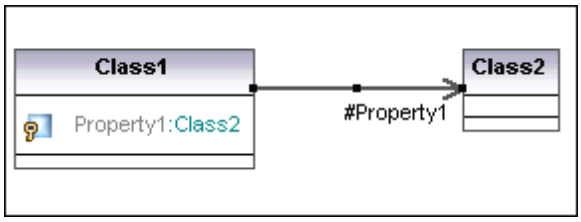
association icon

aggregation

composition

containment

When an association has been created, a new attribute is automatically inserted in the originating (A:name) class, e.g. Property1:Class2, in the example below.



Having created the association it is shown as active, and the Properties tab displays its properties. A text label shows the default name of the member end of the association, i.e. Property1. Note that the context menu option **Text Label...** allows you to show / hide labels.

Clicking an association line, displays the association properties in the Properties tab. A:Name and B:Name indicate the role of each class in the other.

Depending on the "memberEndKind" - **property** (of A:name "Property1"):

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the **attribute** either belongs to:

- the **class** - i.e. **A**:memberEndKind = **memberEnd**, (attribute is visible in class1), or
- the **association** - i.e. **B**:memberEndKind = **ownedEnd** (attribute not visible in class2).

  If both attributes belongs to the **association**, i.e. both ends are defined as "ownedEnd, then this association becomes bi-directional, and the navigability arrow disappears. Both ends of the association are "ownedEnd".

If the memberEndKind of any of the association is set to "**navigableOwnedEnd**, then the attribute is still part of the association, but the navigability arrow reappears depending on which end (A:name or B:Name) it is set.

To define the type of association (association, aggregate, or composite)

1. Click the association arrow.
2. Scroll down to the **aggregation** item in the Properties tab.
3. Select: none, shared or composite.

None: a standard association
shared: an **aggregate** association
composite: a **composite** association.

Please note:

Associations can be created using the same class as both the source and target. This is a so-called self link. It describes the ability of an object to send a message to itself, for recursive calls.

Click the relationship icon, then drag from the element, dropping somewhere else on the same element. A self-link appears.

Displaying associations in Diagrams automatically

When inserting diagram elements in a diagram, the "Automatically create Associations" option in the **Tools | Options | Editing** tab, allows existing associations between modeling elements to be automatically created/displayed in the current diagram. This occurs if the attributes type is set, and the referenced "type" modeling element is in the current diagram.

Deleting relationships/associations:

1. Click the relationship in the diagram tab, or in the Model Tree.
2. Press the **Del.** keyboard key.
   The dependency is deleted from the diagram and project.

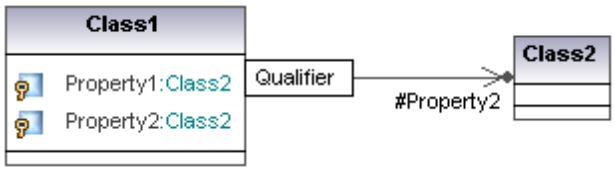
Deleting class associations:

Deleting a **class** association does not delete the **attribute/property** that was automatically generated, from the class!

1. Right click the attribute/property in the class.
2. Select the option "**Delete PropertyX**" from "ClassX" to delete it.

Creating association qualifiers:

1. Having defined an association between two classes
2. Right click the association line and select **New | Qualifier**.

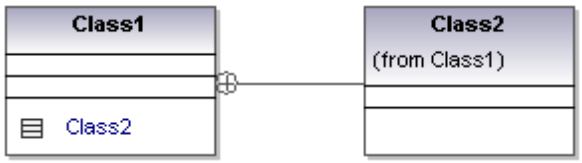


Please note that qualifiers are attributes of an association.

Creating a containment association:

The containment association is used to show parent-child relationships.

1. Click the containment icon in the title bar.
2. Drag from the class that is to be "contained", and drop on the container class.



Note that the contained class, Class2 in this case, is now visible in a compartment of Class1. This generally places the contained class in the same namespace as the container class.

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7.1 Showing model relationships

Showing relationships between modeling elements:

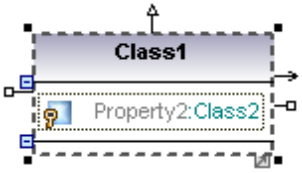
1. Right click the specific element and select **Show**.
   The popup menu shown below is context specific, meaning that only those options are available that are relevant to the specific element.

To show / hide text labels:

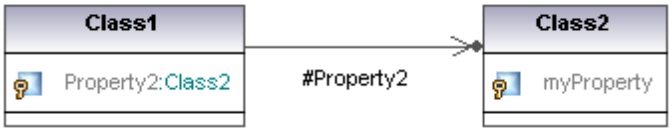
- Right click a class or association arrow and select **Text labels | Show (Hide) all Text labels**.

To show a class attribute/property as an association:

1. Right click the property in the class.



2. Select the menu option **Show | "PropertyXX" as Association**.
   This inserts/opens the referenced class and shows the relevant association.



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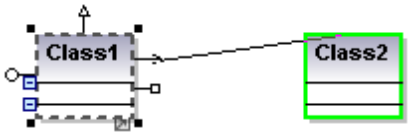
7.2 Associations, realizations and dependencies

Creating relationships using connection handles:

1. Given two classes in the class diagram,
2. Click the first class to make it the active class.
   Connection handles appear on three sides.
3. Move the mouse pointer over the **top** handle on the right side of the class.

   A Tooltip appears, informing you of the type of relationship that this handle creates, Association in this case.
4. Drag to create a connector, and drop it on the second class.
   The target class is highlighted if this type of association is possible.



   An association has now been created between these two classes.

   Note that the **lower** handle of the class element creates a Collection Association.

Elements in the various model diagrams supply you with different connection handles.
E.g. a class in a class diagram supplies the following relationship handles (in clockwise fashion):

- InterfaceRealization
- Generalization
- Association

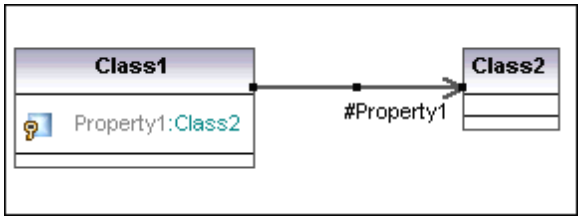
An Artifact in the Deployment view supplies the following handles:

- Manifestation
- Association
- Deployment

Creating relationships using icons in the icon bar:
Given two elements in a modeling diagram,

1. Click the icon that represents the relationship you want to create e.g. association, aggregation, or composition.
2. Drag from the one object to the other, and drop when the target element is highlighted.

   When creating a new association, a new attribute is automatically inserted in the originating (A:name) class, Property1:Class2, in the example below.



UModel always shows all attributes of a class!

Please note:
The screenshots in this manual do not show the Association **Ownership dot**.

To enable it, set the **Show Assoc. Ownership**, in the Styles tab, to true.

Deleting relationships/associations:

1. Click the relationship in the diagram tab, or in the Model Tree.
2. Press the **Del.** keyboard key.
   The dependency is deleted from the diagram and project.

Deleting class associations:
Deleting a **class** association does not delete the **attribute/property** that was automatically generated, from the class!

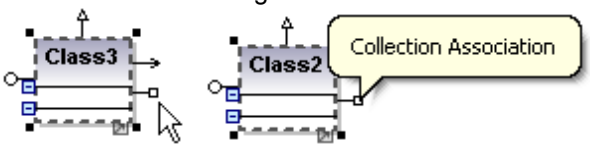
1. Right click the attribute/property in the class.
2. Select the option "**Delete PropertyX**" from "ClassX" to delete it.

Collection Associations

UModel supports a special type of viewing Collection Associations.

Collection associations are special associations for collection templates. A class property (e.g. interface) can generally be shown as an association to the "type" of the property. UModel also allows an alternalte method of viewing this type of association.

Click on the lower of the two class handles on the right of the class, then drag and drop the connector onto the target class.



Select the collection type from the popup menu.

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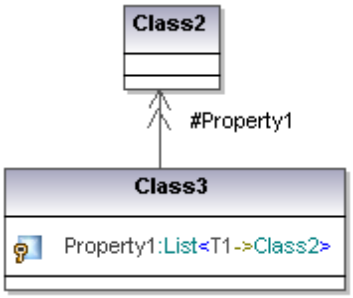
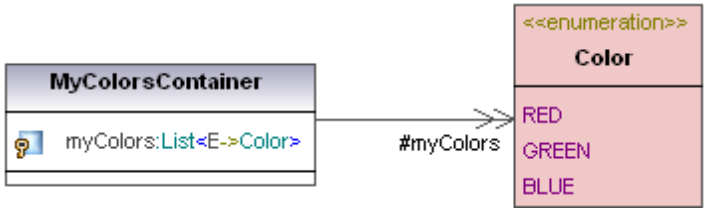
A different type of association arrow is created.

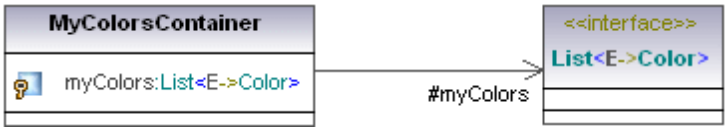


Example:
If associations are automatically created during reverse engineering, you will see them as Collection Associations if the settings in the Diagram Editing tab are set to: Resolve collections and are also available in the Collection Templates dialog box.



The double arrow head shows that the "type" of myColors is not only Color, but a "collection of" Colors.
The assocation will not be shown as List<E->Color>, but directly to the enumeration "Color", thus hiding the information that Color is used in a template binding.

The concrete collection type of myColors can still be seen in the myColorsContainer, but not in the association.



The Diagram Editing tab of the **Tools | Options** dialog box allows you to specify the templates where you want this behavior and whether you want the collections to be resolved.

Chapter 8

Generating UML documentation

8 Generating UML documentation

Altova web site: UML project documentation

The **Generate Documentation** command generates detailed documentation about your UML project in HTML, MS Word, RTF or PDF. The documentation generated by this command can be freely altered and used; permission from Altova to do so is not required.

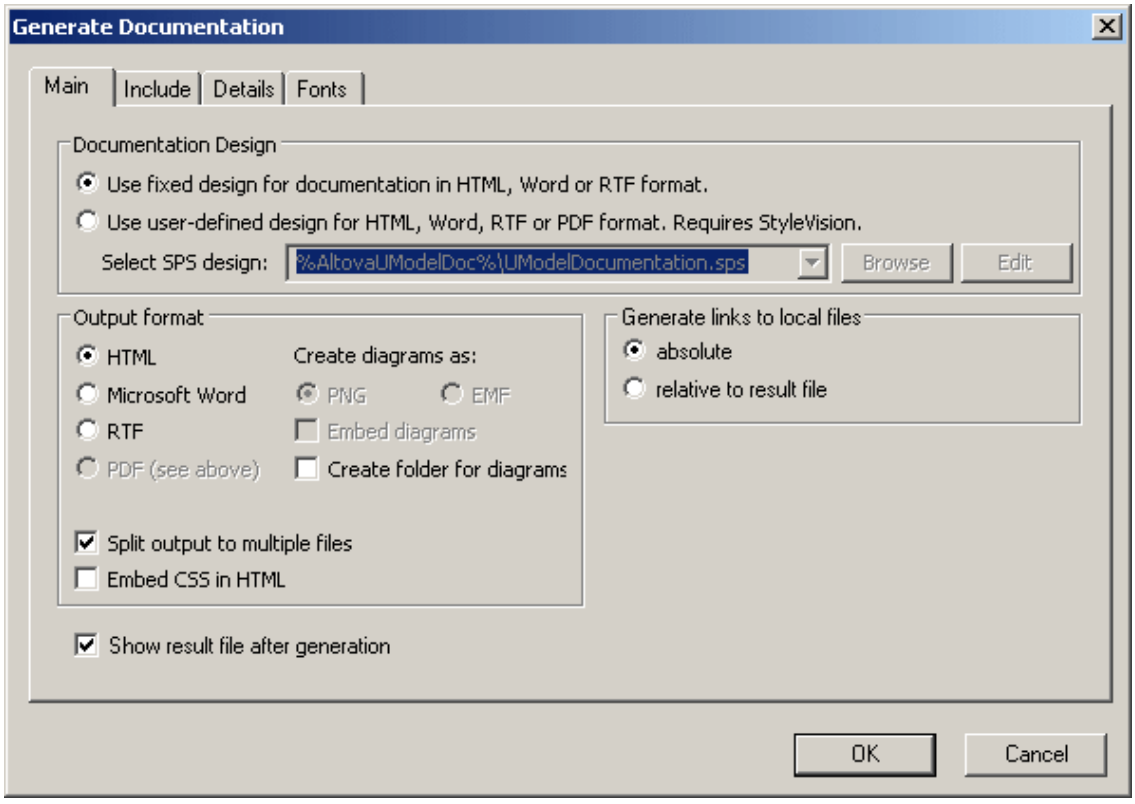
Documentation is generated for the modeling elements you select in the Generate Documentation dialog box. You can either use the fixed design, or use a StyleVision SPS for the design. Using a StyleVision SPS enables you to customize the output of the generated documentation. How to do this is explained in the section, User-Defined Stylesheets.

Note: To use an SPS to generate documentation, you must have StyleVision installed on your machine. Related elements are typically hyperlinked in the onscreen output, enabling you to navigate from component to component.

To generate documentation in MS Word format, you must have MS Word (version 2000 or later) installed.

Having opened a UML project e.g. Bank_Multilanguage.ump:

1. Select the menu option **Project | Generate Documentation**.
   This opens the "Generate documentation" dialog box. The screenshot below shows the default dialog box settings.



Note that you can also create **partial documentation** of modeling elements by right clicking an

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element (or **multiple** elements using CTRL + click) in the Model Tree and selecting "Generate Documentation". The element can be a folder, class, interface etc. The documentation options are the same in both cases.

Related elements are hyperlinked in the onscreen output, enabling you to navigate from component to component. All manually created hyperlinks also appear in the documentation.

Note also:
documentation is also generated for **included** C#, Java and/or VB subprojects (profiles) if enabled in the Include tab!

Main tab:

Documentation Design

- Select "Use fixed design..." to use the built-in documentation template.
- Select "Use user-defined..." to use a predefined StyleVision Power Stylesheet created in StyleVision. The SPS files are available in the **...\My Documents\Altova\UModel2016 \Documentation\UModel** folder.
- Click **Browse** to browse for a predefined SPS file.
- Click **Edit** to launch StyleVision and open the selected SPS in a StyleVision window.

Output format:

- The output format is specified here: either HTML, Microsoft Word, RTF, or PDF.

  Microsoft Word documents are created with the **.doc** file extension when generated using a fixed design, and with a **.docx** file extension when generated using a StyleVision SPS.

  The **PDF** output format is only available if you use a StyleVision SPS to generate the documentation.

- "**Split output to multiple files**" generates an output file for each modeling element that would appear in the TOC overview when generating a single output file e.g. a class C1 with a nested class CNest exists; C1.html contains all info pertaining to C1 and CNest as well as all their attributes, properties etc

- The **Embed CSS in HTML** option allows you to embed an existing (referenced) CSS file in the HTML documentation, when active; or keep the reference to the CSS file, and the file itself, external when inactive.

- The **Embed diagrams** option is enabled for the Microsoft Word and RTF output options. When this option is selected, diagrams are embedded in the generated file. Diagrams are created as PNG files (for HTML), or PNG/EMF files (for MS Word and RTF), which are displayed in the result file via object links.

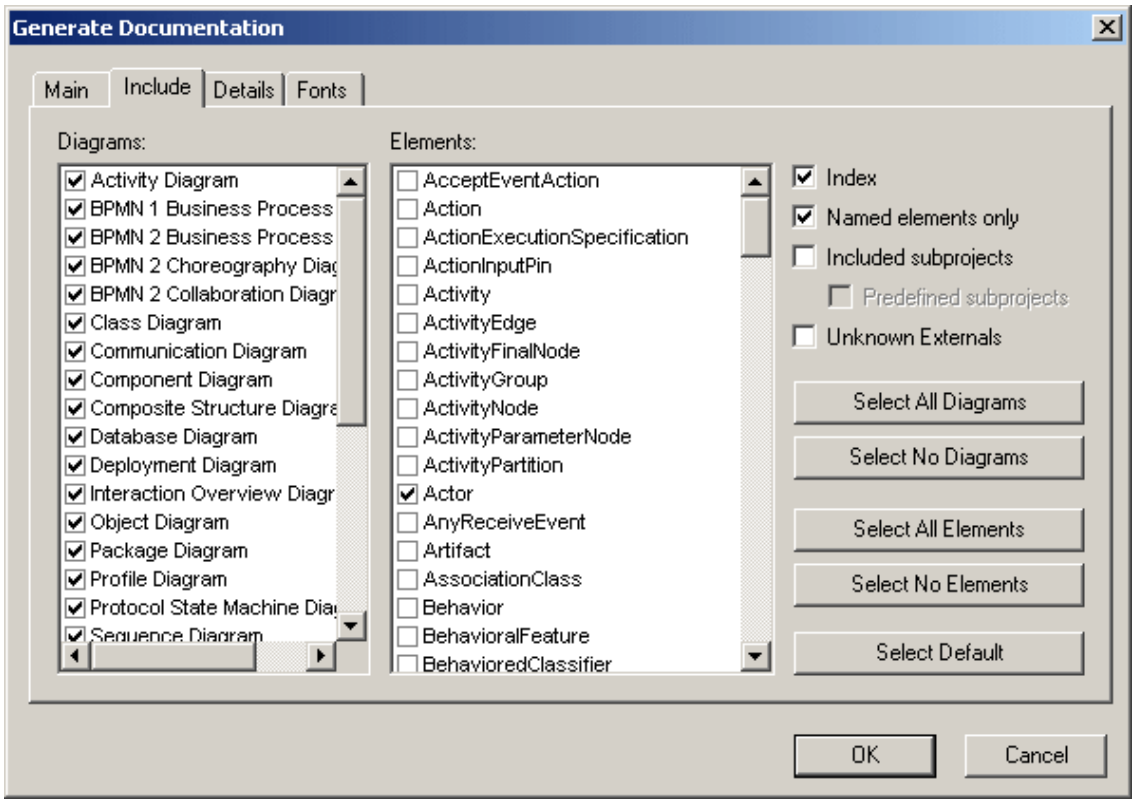
- **Create folder for diagrams** generates a subfolder, below the selected output folder, that will contain all diagrams when the documentation is output.

- The "**Show Result File...**" option is enabled for all output options. When checked, the result files are displayed in Browser View (HTML output), MS Word (MS Word output), and the default application for .rtf files (RTF output).

- **Generate links to local files** option allows you to specify if the generated links are to be absolute, or relative, to the output file.

Include tab

allows you to select which diagrams and modeling elements are to appear in the documentation.



Note that documenting subprojects can be disabled by deselecting the "Included subprojects" check box.

Details tab

allows you to select the element details that are to appear in the documentation.

- If you intend to import **XML tags** text in your documentation, please **de**-activate the "as HTML" option under the Documentation option.
- The up / down fields allow you to define the nesting depth shown above/below the current class in the hierarchy diagram.
- The "expand each element only once" option, only allows one of the same classifiers to be expanded in the same image/diagram.

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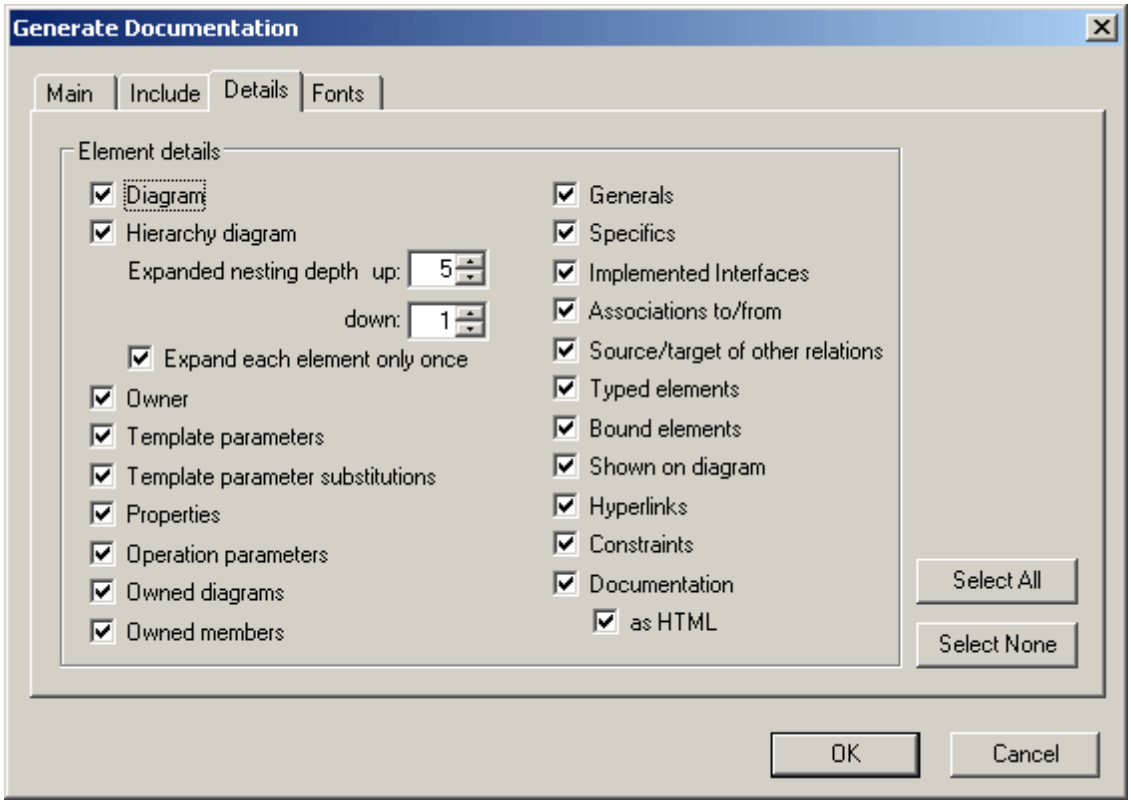
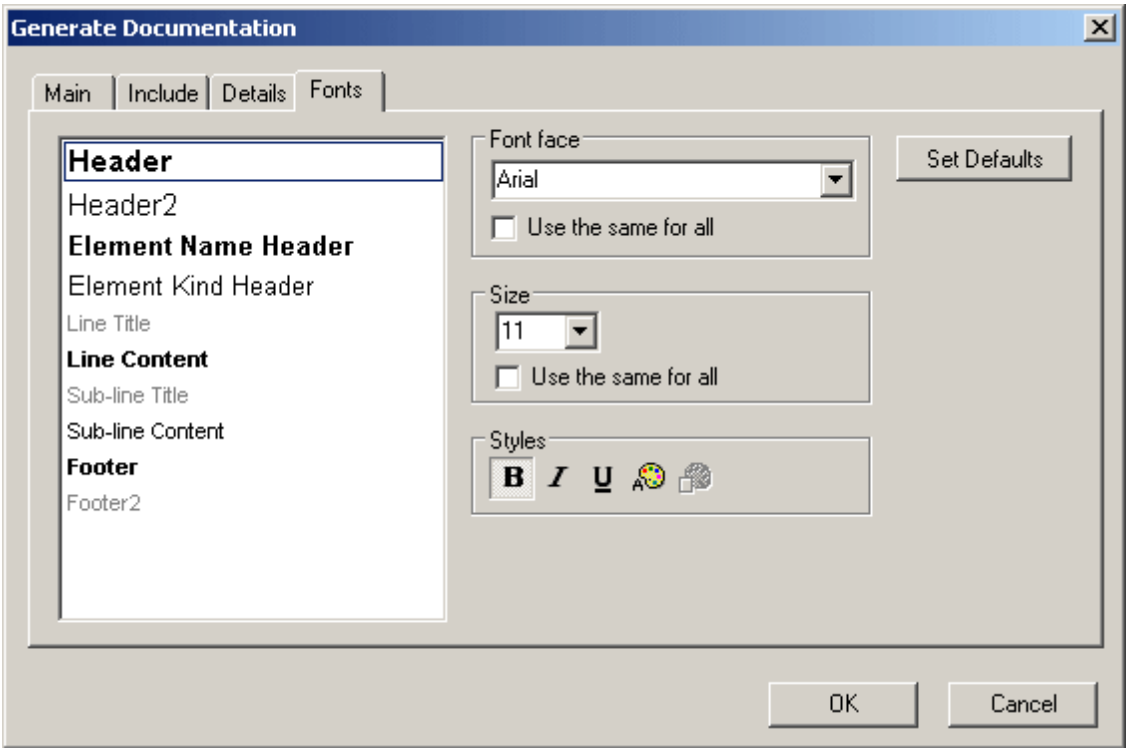


Fonts tab

allows you to customize the font settings for the various headers and text content.



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The following screenshots show the fixed-design documentation for the Bank_MultiLanguage.ump file that is included in the ...\UModelExamples directory.

Bank_MultiLanguage.ump

project location **Bank_MultiLanguage.ump**

Index of diagrams:

Activity Diagram	collectData Draft		
Class Diagram	Apply Java Profile	Bank Server	BankView Main
Component Diagram	Bank realizations	Overview	
Composite Structure Diagram	Account Transfer		
Deployment Diagram	Deployment		
Object Diagram	Sample Accounts		
Sequence Diagram	Collect Account Information	Connect to BankAPI	
State Machine Diagram	BankAPI Draft	Query BankServer Draft	
UseCase Diagram	Overview Account Balance		

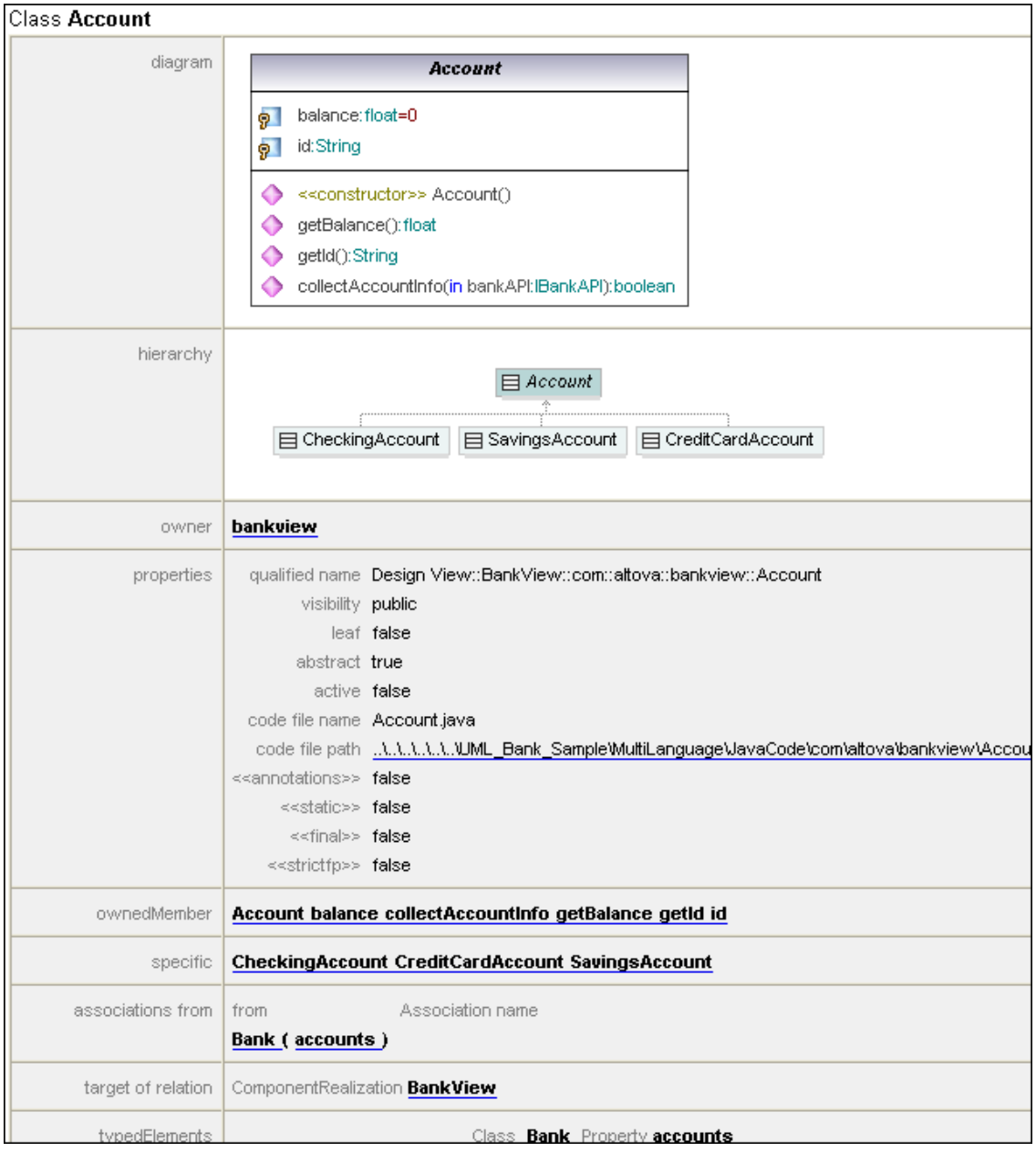
Index of elements:

Activity	BankView		
Actor	Bank	Standard User	
Artifact	BankAddresses.ini	BankAPI.jar	BankServer
Class	Account CheckingAccount	Bank CreditCardAccount	BankServer SavingsAccount
Collaboration	Account Transfer	Bank Account Transfer	
Component	Bank API client	BankServer	BankView
Enumeration	AccountType		
InstanceSpecification	AgencyBank	John's 1st	John's 2nd
Interaction	Collect Account Information	Connect to BankAPI	
Interface	IBankAPI		

The screenshot above shows the generated documentation with the diagram and element index links at the top of the HTML file.

The screenshot below shows the specifics of the Account class and its relation to other classes.

Note that the individual attributes and properties in the class diagrams are also hyperlinked to their definitions. Clicking a property takes you to its definition. The individual hierarchy classes, as well as all underlined text, are hyperlinked.



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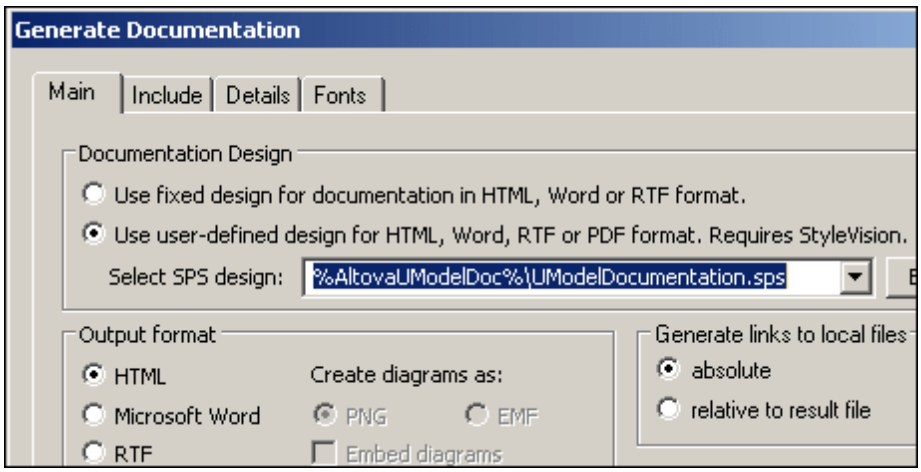
8.1 Supplied SPS stylesheet

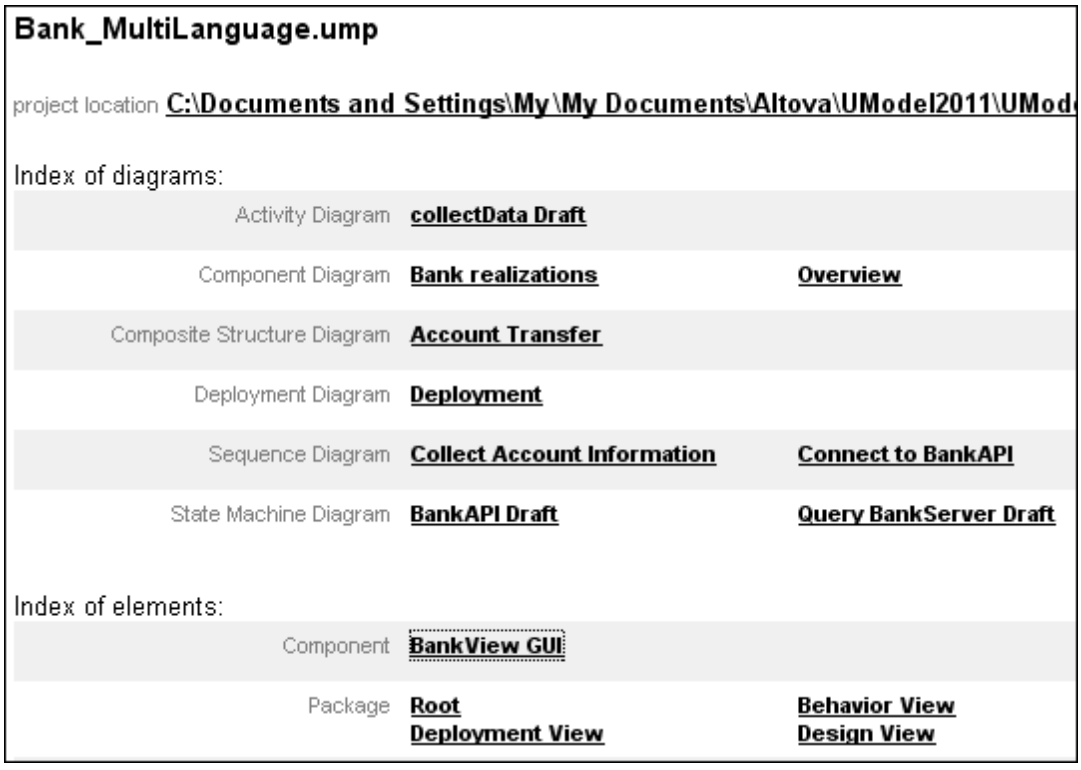
To generate documentation based on the supplied SPS file:

1. Select the menu option **Project | Generate Documentation.**
2. Select the "Use User-Defined Design..." radio button.
3. Select the **UModelDocumentation.sps** stylesheet (if not automatically selected) in the Generate Documentation dialog box.



You are now prompted to save the file.

4. Enter the file name and select the location you want to save it.


Bank_MultiLanguage.ump
project location C:\Documents and Settings\My\My Documents\Altova\UModel2011\UMod
Index of diagrams:
Activity Diagram collectData Draft
Component Diagram Bank realizations Overview
Composite Structure Diagram Account Transfer
Deployment Diagram Deployment
Sequence Diagram Collect Account Information Connect to BankAPI
State Machine Diagram BankAPI Draft Query BankServer Draft
Index of elements:
Component BankView GUI
Package Root Behavior View
Deployment View Design View

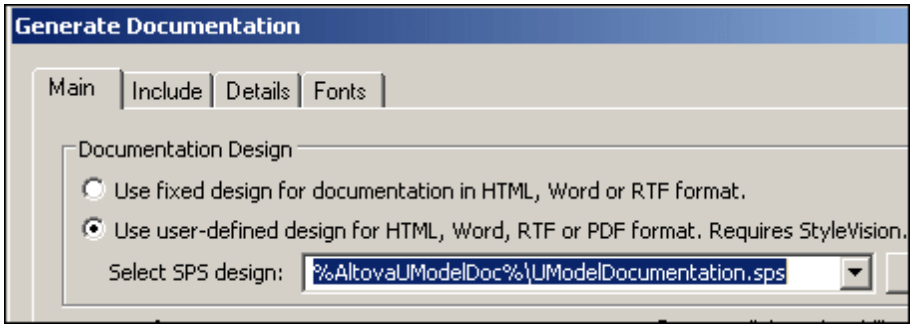
Clicking a link, in the generated documentation, navigates to the modeling element in the browser.

8.2 User-defined Stylesheets

Instead of using the fixed design, you can create a customized design for the UModel documentation. The customized design is created in a StyleVision SPS. Note that the predefined SPS Stylesheet is supplied with UModel.

Specifying the SPS to use for UModel documentation

The SPS you wish to use for generating the documentation is specified in the Generate Documentation dialog (accessed via **Project | Generate Documentation**). Select the "Use User-Defined Design..." radio button. The default selection is the **UModelDocumentation.sps** entry.



The predefined SPS file is located in the **...\Documentation\UModel** folder.

Please note:

To use an SPS to generate documentation, you must have StyleVision installed on your machine.

Creating the SPS

A StyleVision Power Stylesheet (or SPS) is created using Altova's StyleVision product. An SPS for generating UModel documentation must be based on the XML Schema that specifies the structure of the XML document that contains the UModel documentation.

This schema is called **UModelDocumentation.xsd** and is delivered with your UModel installation package. It is stored in the ...\My Documents\Altova\UModel2016\Documentation\UModel folder.

When creating the SPS design in StyleVision, nodes from the UModelDocumentation.xsd schema are placed in the design and assigned styles and properties. Note that the UModelDocumentation.xsd **includes** the Documentation.xsd file located in the folder above it.

Additional components, such as links and images, can also be added to the SPS design. How to create an SPS design in StyleVision is described in detail in the StyleVision user manual.

The advantage of using an SPS for generating schema documentation is that you have complete control over the design of the documentation. Note also that PDF output of the documentation is available only if an SPS is used; PDF output is not available if the fixed design is used.

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Chapter 9

UML Diagrams

9 UML Diagrams

There are two major groups of UML diagrams, Structural diagrams, which show the static view of the model, and Behavioral diagrams, which show the dynamic view. UModel supports all fourteen diagrams of the UML 2.4 specification as well as: XML Schema and Business Modeling Notation diagrams.

Behavioral diagrams include Activity, State machine, Protocol State Machine and Use Case diagrams; as well as the Interaction, Communication, Interaction Overview, Sequence, and Timing diagrams.

Structural diagrams include: Class, Composite Structure, Component, Deployment, Object, and Package diagrams.

Additional diagrams XML schema diagrams.

Please note:
The **CTRL+Enter** keys can be used to create multi-line labels for most of the modeling diagrams, e.g. Lifeline labels in sequence diagrams, timing diagrams; guard conditions, state names, activity names etc.

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9.1 Behavioral Diagrams

These diagrams depict behavioral features of a system or business process, and include a subset of diagrams which emphasize object interactions.

Behavioral Diagrams

- Activity Diagram
- State Machine Diagram
- Protocol State Machine Diagram
- Use Case Diagram

A subset of the Behavioral diagrams are those that depict the object interactions, namely:

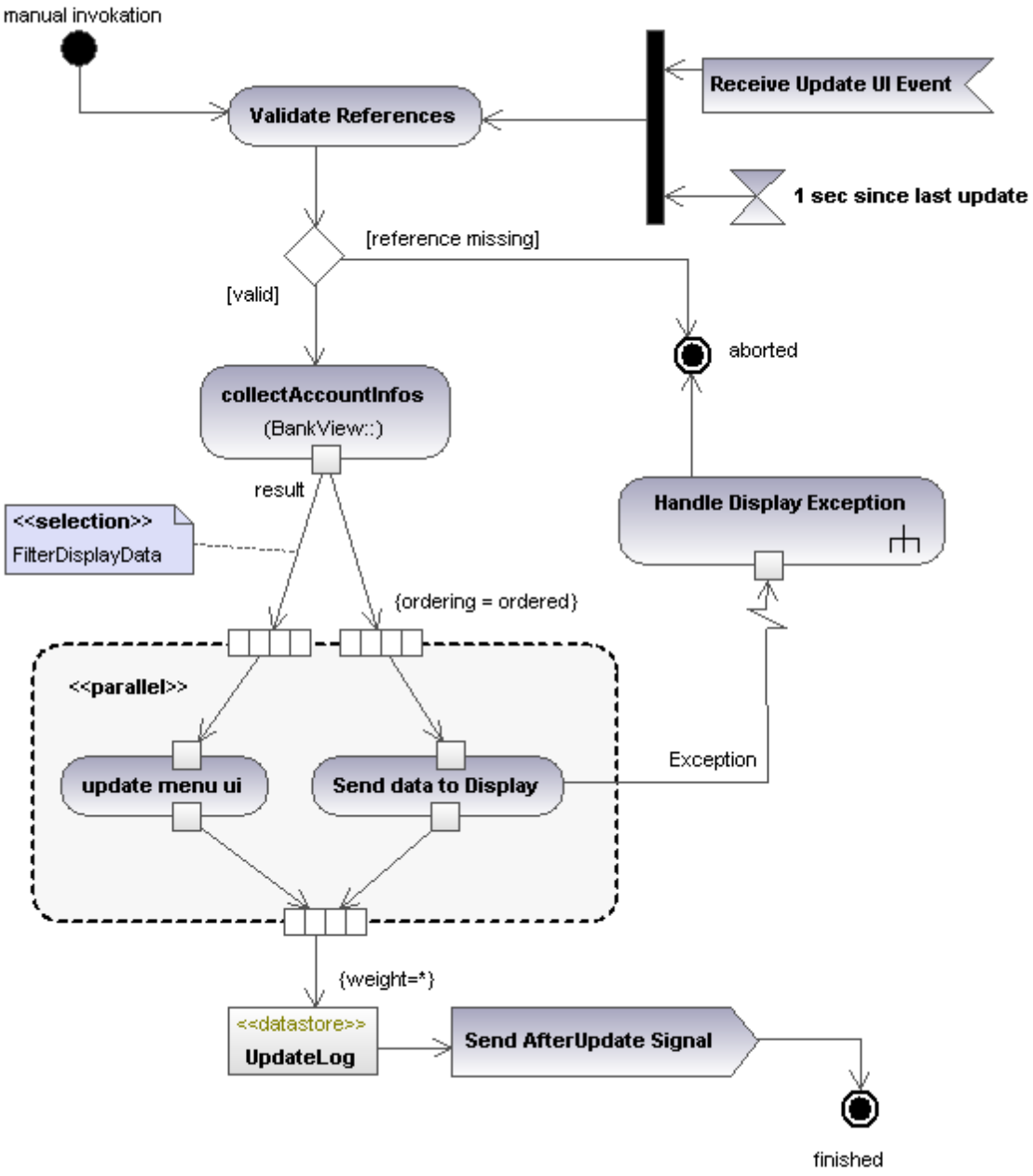
- Communication Diagram
- Interaction Overview Diagram
- Sequence Diagram
- Timing Diagram

9.1.1 Activity Diagram

Altova web site: UML Activity diagrams

Activity diagrams are useful for modeling real-world workflows of business processes, and display which actions need to take place and what the behavioral dependencies are. The Activity diagram describes the specific sequencing of activities and supports both conditional and parallel processing. The Activity diagram is a variant of the State diagram, with the states being activities.

Please note that the Activity diagram shown in the following section is available in the **Bank_MultiLanguage.ump** sample, in the ...**UModelExamples** folder supplied with UModel.



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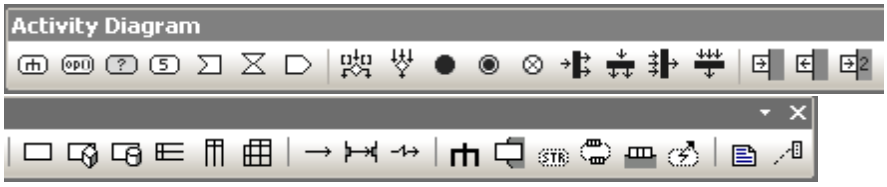
Inserting Activity Diagram elements



Using the toolbar icons:

1. Click the specific activity diagram icon in the Activity Diagram toolbar.
2. Click in the Activity Diagram to insert the element.
   Note that holding down CTRL and clicking in the diagram tab, allows you to insert multiple elements of the type you selected.

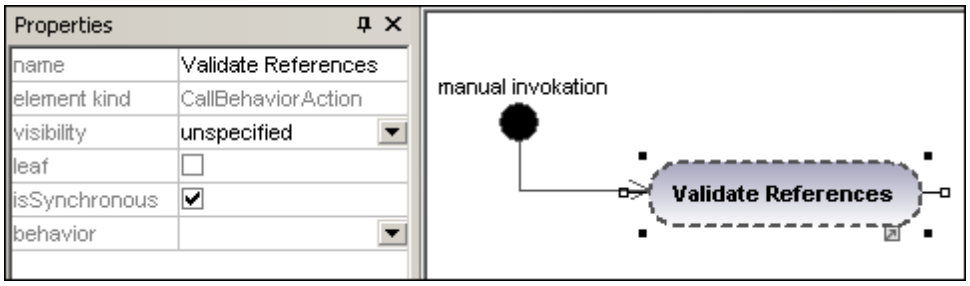
Dragging existing elements into the activity diagram:

Most elements occurring in other activity diagrams, can be inserted into an existing activity diagram.

1. Locate the element you want to insert in the Model Tree tab (you can use the search function text box, or press CTRL+F, to search for any element).
2. Drag the element(s) into the activity diagram.

Inserting an action (CallBehavior):

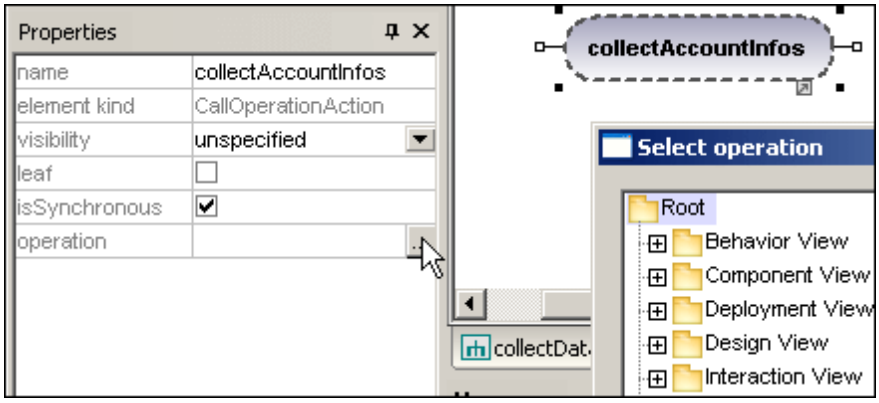
1. Click the Action (CallBehavior) icon in the icon bar, and click in the Activity diagram to insert it.
2. Enter the name of the Action, e.g. Validate References, and press Enter to confirm.



Note: Use CTRL+Enter to create a multi-line name.

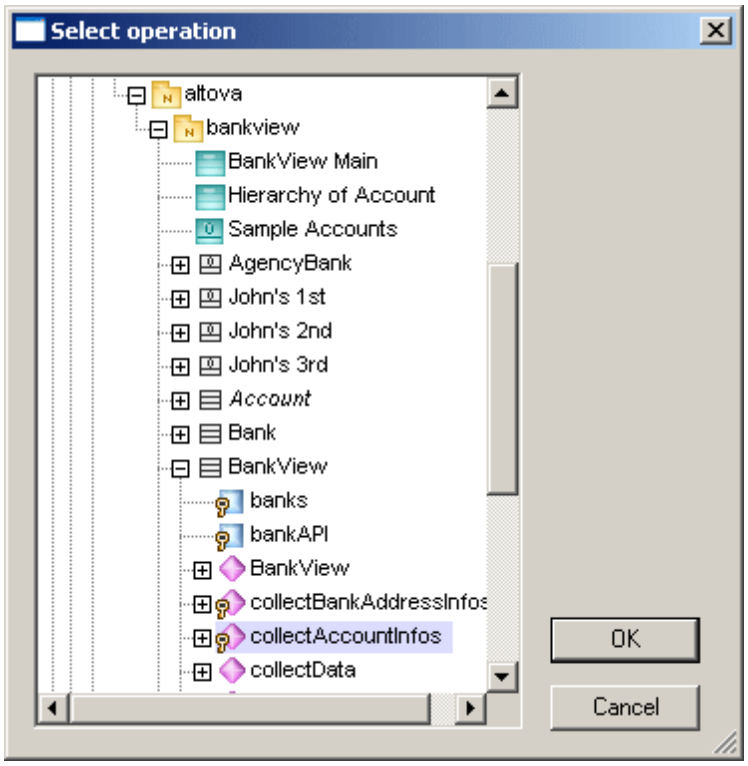
Inserting an action (CallOperation) and selecting a specific operation:

1. Click the Action (CallOperation) icon in the icon bar, and click in the Activity diagram to insert it.
2. Enter the name of the Action, e.g. collectAccountInfo, and press Enter to confirm.
3. Click the Browse button to the right of the operation field in the Properties tab.

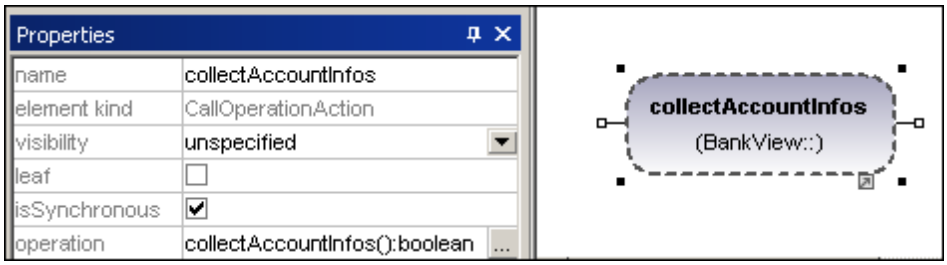


This opens the "Select Operation" dialog box in which you can select the specific operation.

4. Navigate to the specific operation that you want to insert, and click OK to confirm.



In this example the operation "collectAccountInfos" is in the BankView class.



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Creating branches and merges

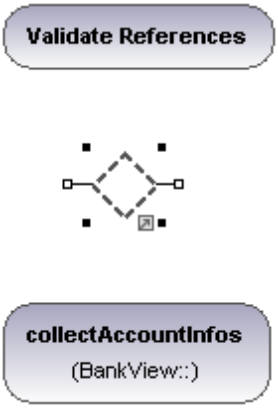
Creating a branch (alternate flow)

A branch has a single incoming flow and multiple outgoing guarded flows. Only one of the outgoing flows can be traversed, so the guards should be mutually exclusive.

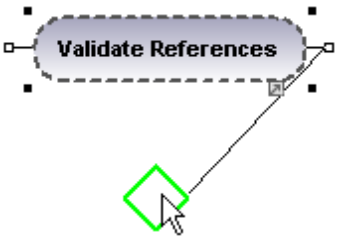
In this example the (BankView) references are to be validated:

- branch1 has the guard "reference missing", which transitions to the abort activity
- branch2 has the guard "valid", which transitions to the collectAccountInfos activity.

1. Click the **DecisionNode** icon in the title bar, and insert it in the Activity diagram.

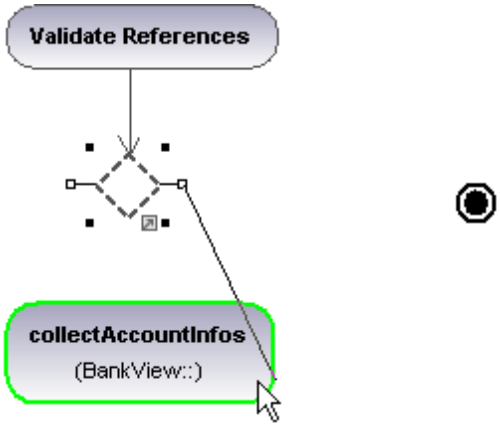


2. Click the ActivityFinalNode icon which represents the abort activity, and insert it into the Activity diagram.
3. Click the Validate References activity to select it, then click the right-hand handle, **ControlFlow**, and drag the resulting connector onto the DecisionNode element.

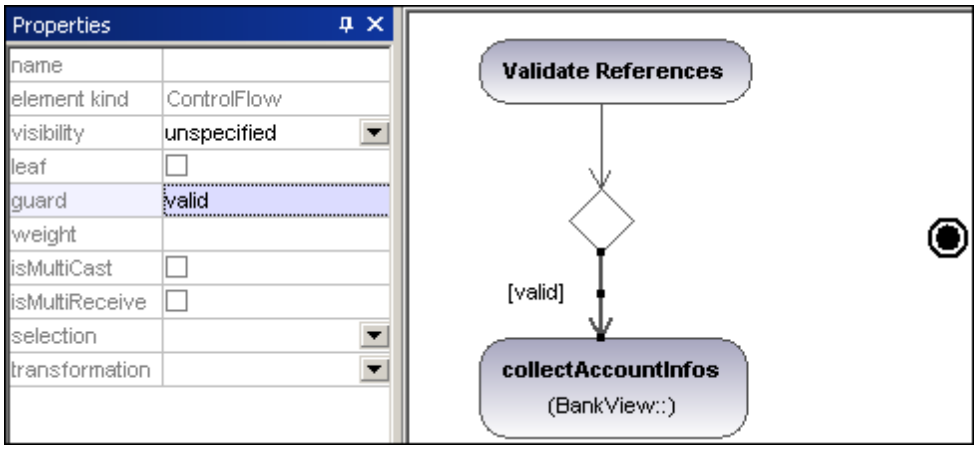


The element is highlighted when you can drop the connector.

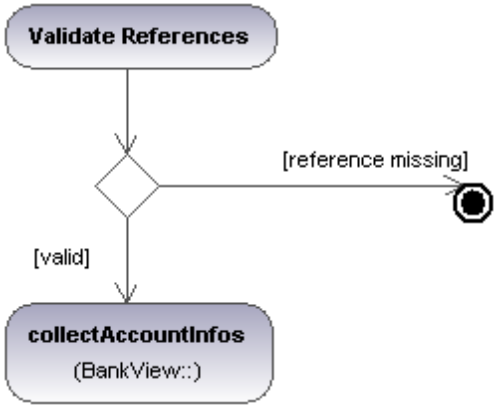
4. Click the DecisionNode element, click the right-hand connector, **ControlFlow**, and drop it on the collectAccountInfos action. Please see "Inserting an Action (CallOperation" for more information.



5. Enter the guard condition "valid", in the guard field of the Properties tab.



6. Click the **DecisionNode** element and drag from the right-hand handle, **ControlFlow**, and drop it on the ActivityFinalNode element.
The guard condition on this transition is automatically defined as "else". Double click the guard condition in the diagram to change it e.g. "reference missing".



Please note that UModel does not validate, or check, the number of Control/Object Flows in a diagram.

Creating a merge:

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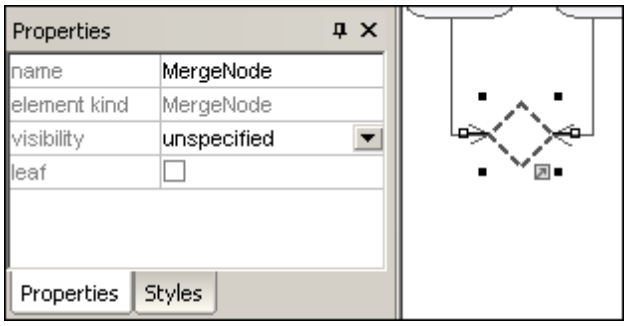
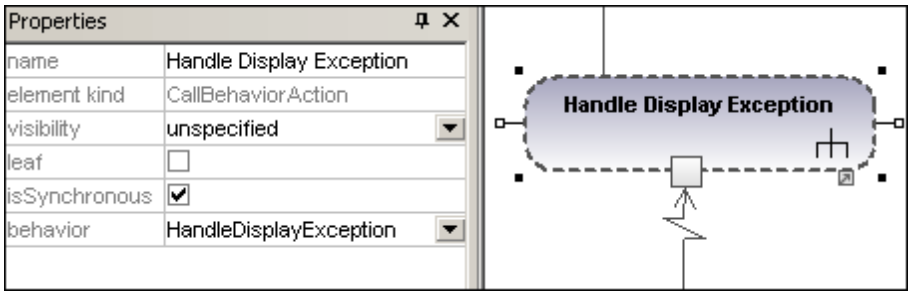
1. Click the MergeNode icon in the icon bar, then click in the Activity diagram to insert it.



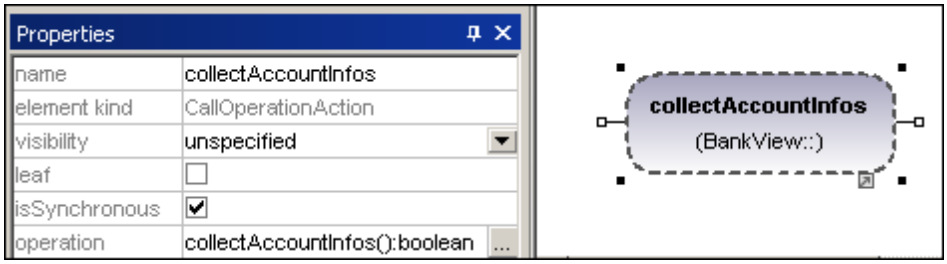
2. Click the ControlFlow (ObjectFlow) handles of the actions that are to be merged, and drop the arrow(s) on the MergeNode symbol.

Activity Diagram elements

Action (CallBehavior)
Inserts the Call Behavior Action element which directly invokes a specific behavior.
Selecting an existing behavior using the **behavior** combo box, e.g. HandleDisplayException, and displays a rake symbol within the element.



Action (CallOperation)
Inserts the Call Operation Action which indirectly invokes a specific behavior as a method. Please see "Inserting an action (CallOperation)" for more information.

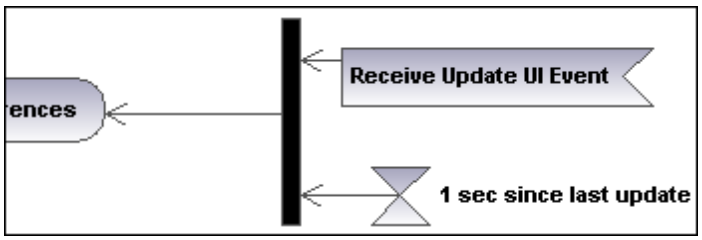


Action (OpaqueAction)
A type of action used to specify implementation information. Can be used as a placeholder until you decide which specific action type you want to use.

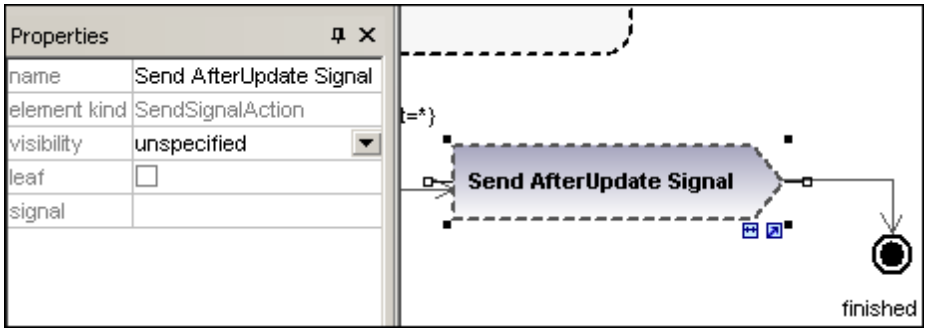
Action (ValueSpecificationAction)
A type of action that evaluates(/generates) a specific value at the output pin. (Defined by the specific properties, e.g. upperBound.)

AcceptEventAction
Inserts the Accept Event action which waits for the occurrence of an event which meets specific conditions.

AcceptEventAction (TimeEvent)
Inserts a AcceptEvent action, triggered by a time event, which specifies an instant of time by an expression e.g. 1 sec. since last update.



SendSignalAction
Inserts the Send Signal action, which creates a signal from its inputs and transmits the signal to the target object, where it may cause the execution of an activity.



DecisionNode
Inserts a Decision Node which has a single incoming transition and multiple outgoing guarded transitions. Please see "Creating a branch" for more information.

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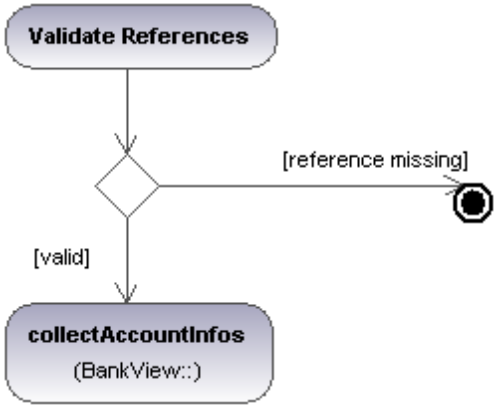


MergeNode
Inserts a Merge Node which merges multiple alternate transitions defined by the Decision Node. The Merge Node does not synchronize concurrent processes, but selects one of the processes.

InitialNode
The beginning of the activity process. An activity can have more than one initial node.

ActivityFinalNode
The end of the activity process. An activity can have more that one final node, all flows in the activity stop when the "first" final node is encountered.

FlowFinalNode
Inserts the Flow Final Node, which terminates a flow. The termination does not affect any other flows in the activity.

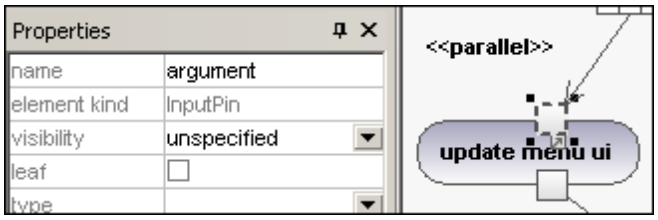
ForkNode
Inserts a vertical Fork node.
Used to divide flows into multiple concurrent flows.

ForkNode (Horizontal)
Inserts a horizontal Fork node.
Used to divide flows into multiple concurrent flows.

JoinNode
Inserts a vertical Fork node.
A Join node synchronizes multiple flows defined by the Fork node.

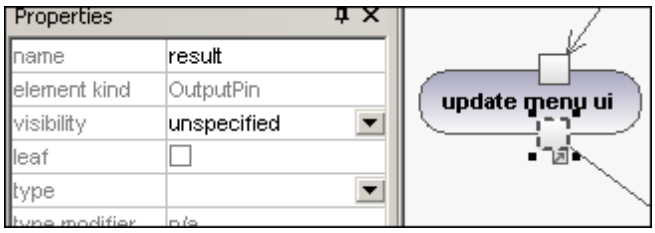
Join Node (horizontal)
Inserts a horizontal Fork node.
A Join node synchronizes multiple flows defined by the Fork node.

InputPin
Inserts an input pin onto a Call Behavior, or Call Operation action. Input pins supply input values that are used by an action. A default name, "argument", is automatically assigned to an input pin.



The input pin symbol can only be placed onto those activity elements where the mouse pointer changes to the hand symbol . Dragging the symbol repositions it on the element border.

OutputPin
Inserts an output pin action. Output pins contain output values produced by an action. A name corresponding to the UML property of that action e.g. result, is automatically assigned to the output pin.



The output pin symbol can only be placed onto those activity elements where the mouse pointer changes to the hand symbol . Dragging the symbol repositions it on the element border.

Exception Pin
An OutputPin can be changed to an Exception pin by clicking the pin and selecting "isExceptionPin" from the Properties pane.

ValuePin
Inserts a Value Pin which is an input pin that provides a value to an action, that does not come from an incoming object flow. It is displayed as an input pin symbol, and has the same properties as an input pin.

ObjectNode
Inserts an object node which is an abstract activity node that defines object flow in an activity. Object nodes can only contain values at runtime that conform to the type of the object node.

CentralBufferNode
Inserts a Central Buffer Node which acts as a buffer for multiple in- and out flows from other object nodes.

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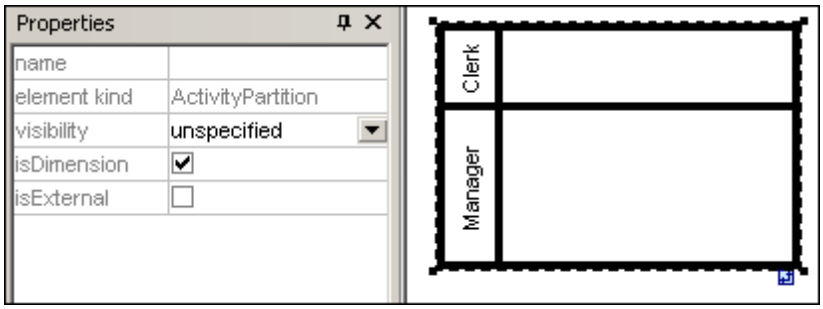
DataStoreNode
Inserts a Data Store Node which is a special "Central Buffer Node" used to store persistent (i.e. non transient) data.

ActivityPartition (horizontal)
Inserts a horizontal Activity Partition, which is a type of activity group used to identify actions that have some characteristic in common. This often corresponds to organizational units in a business model.

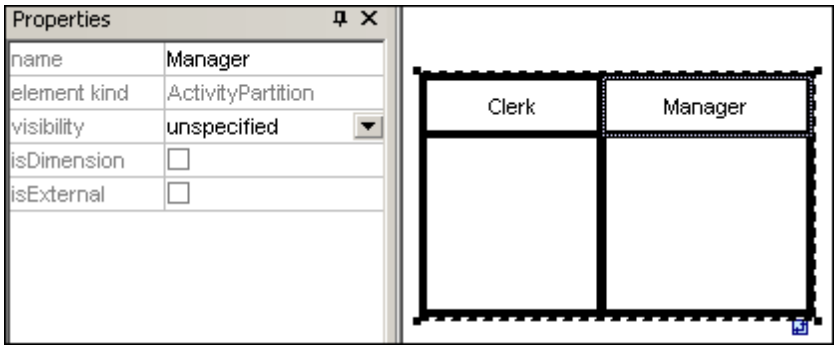


Double clicking a label allows you to edit it directly; pressing Enter orients the text correctly.

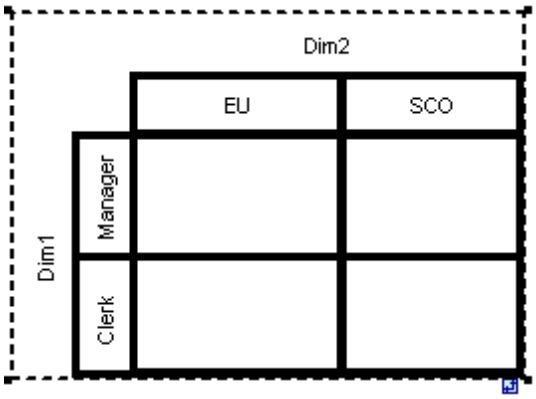
Please note that Activity Partitions are the UML 2.0 update to the "swimlane" functionality of previous UML versions.

- Elements placed within a ActivityPartition become part of it when the boundary is highlighted.
- Objects within an ActivityPartition can be individually selected using CTRL+Click, or by dragging the marquee inside the boundary.
- Click the ActivityPartition boundary, or title, and drag to reposition it.

ActivityPartition (vertical)
Inserts a vertical Activity Partition, which is a type of activity group used to identify actions that have some characteristic in common. This often corresponds to organizational units in a business model.

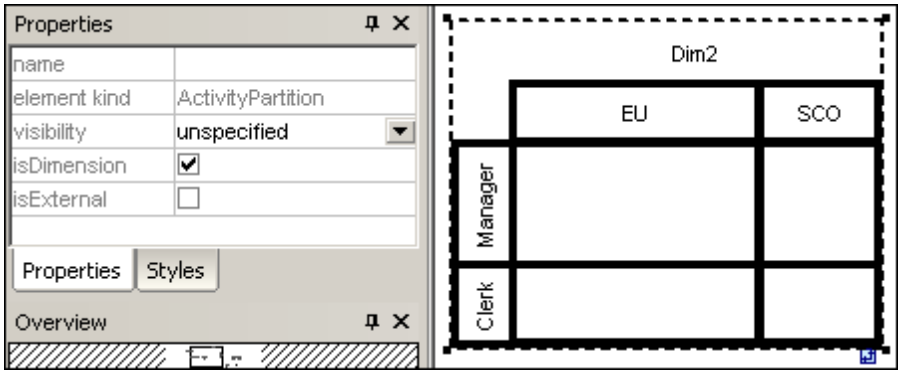


ActivityPartition (2 Dimensional)
Inserts a two dimensional Activity Partition, which is a type of activity group used to identify actions that have some characteristic in common. Both axes have editable labels.



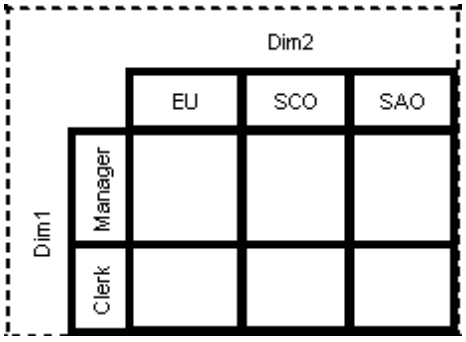
To remove the Dim1, Dim2 dimension labels:

1. Click the dimension label you want to remove e.g. Dim1
2. Double click in the Dim1 entry in the Properties tab, delete the Dim1 entry, and press Enter to confirm.



Note that Activity Partitions can be nested:

1. Right click the label where you want to insert a new partition.
2. Select **New | ActivityPartition**.



ControlFlow

A Control Flow is an edge, i.e. an arrowed line, that connects two activities/behaviours, and starts an activity after the previous one has been completed.

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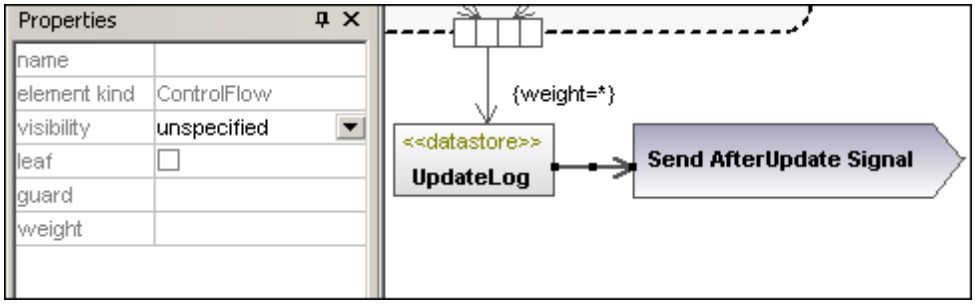
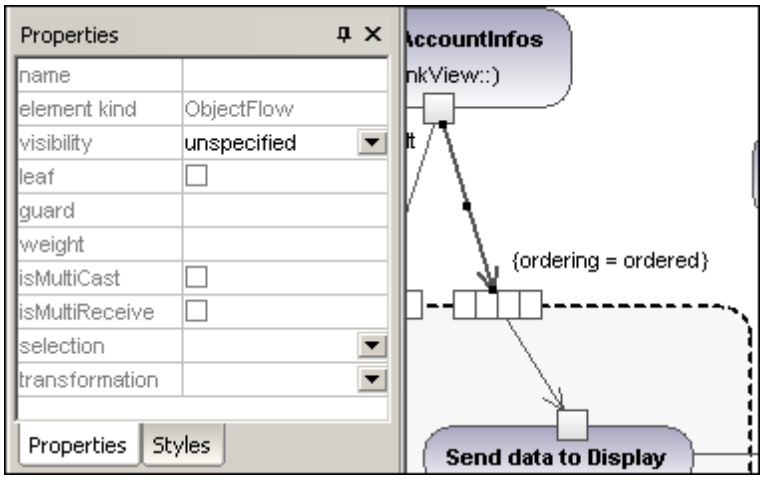


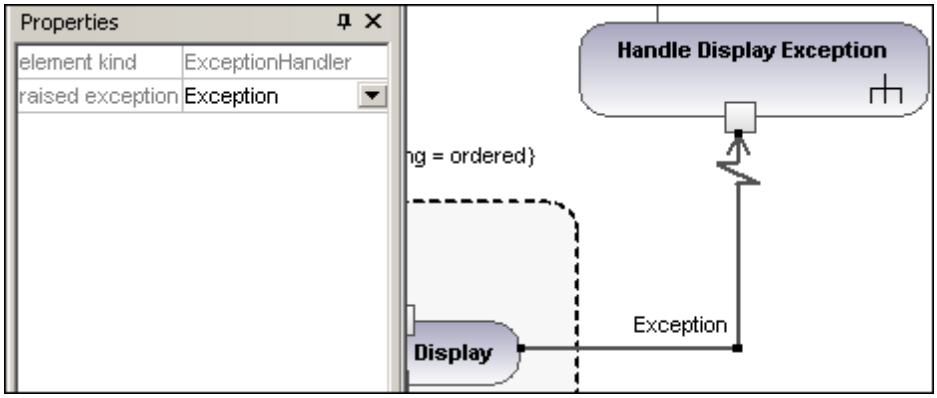
ObjectFlow

A Object Flow is an edge, i.e. an arrowed line, that connects two actions/object nodes, and starts an activity after the previous one has been completed. Objects or data can be passed along an Object Flow.



ExceptionHandler

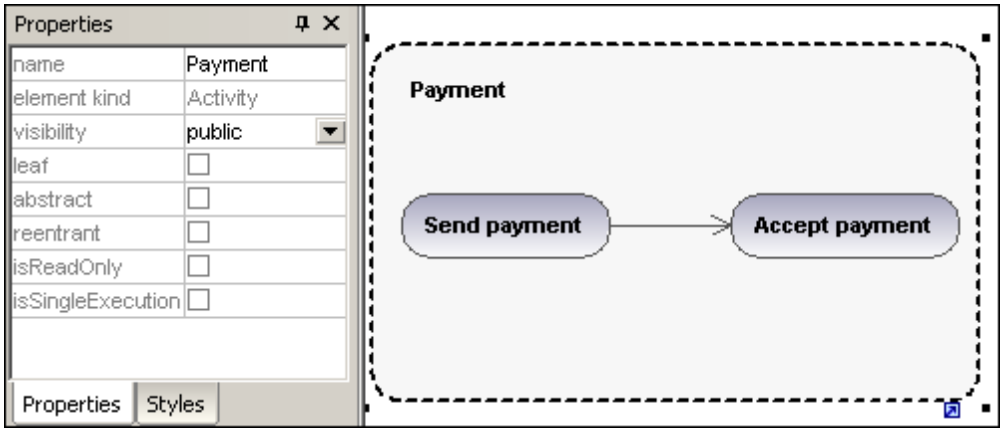
An Exception Handler is an element that specifies what action is to be executed if a specified exception occurs during the execution of the protected node.



An Exception Handler can only be dropped on an Input Pin of an Action.

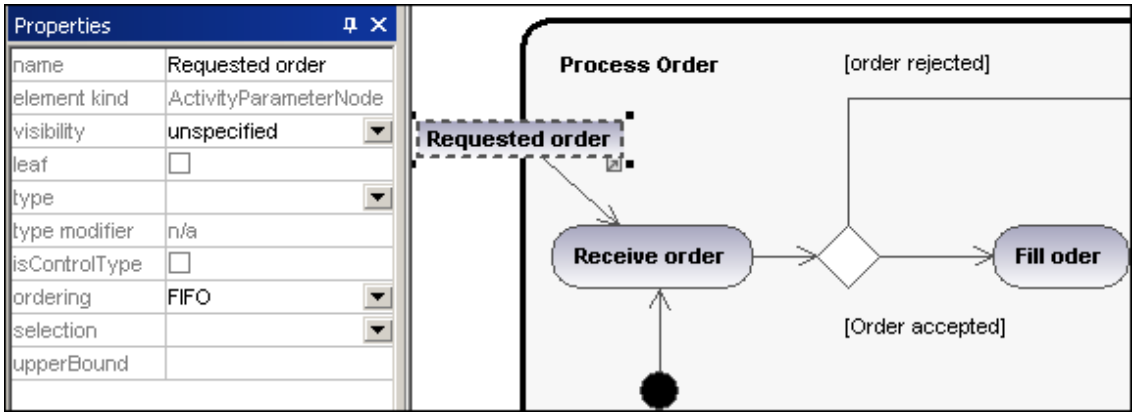
Activity

Inserts an Activity into the activity diagram.



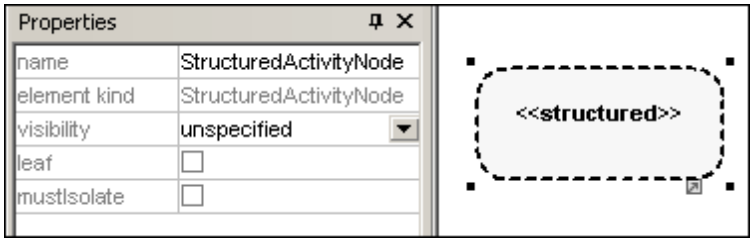
ActivityParameterNode

Inserts an Activity Parameter node onto an activity. Clicking anywhere in the activity places the parameter node on the activity boundary.



StructuredActivityNode

Inserts a Structured Activity Node which is a structured part of the activity, that is not shared with any other structured node.



ExpansionRegion

An expansion region is a region of an activity having explicit input and outputs (using ExpansionNodes). Each input is a collection of values.

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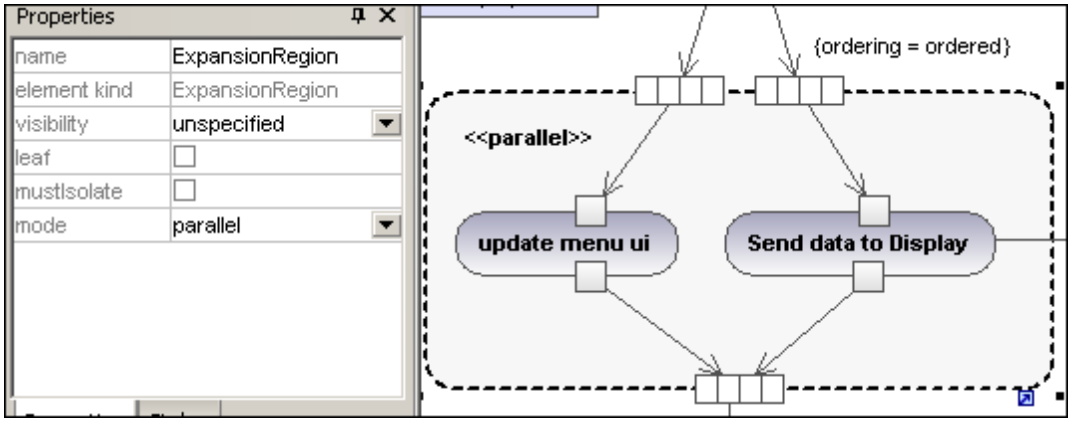
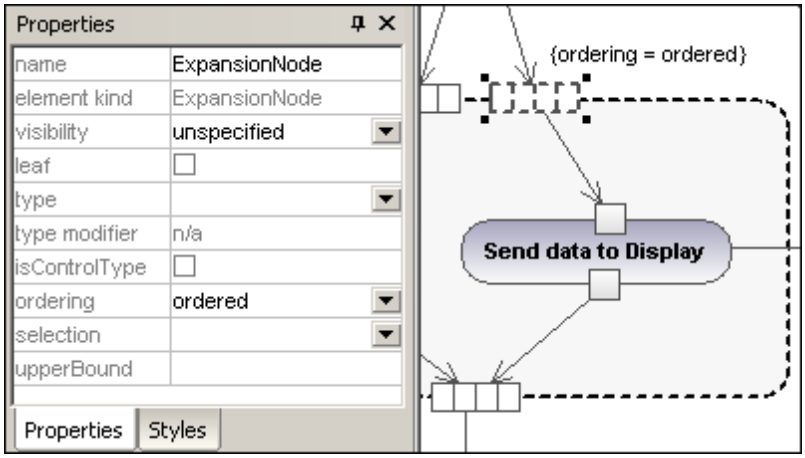


The expansion region mode is displayed as a keyword, and can be changed by clicking the "mode" combo box in the Properties tab. Available settings are:parallel, iterative, or stream.

ExpansionNode

Inserts an Expansion Node onto an Expansion Region. Expansion nodes are input and output nodes for the Expansion Region, where each input/output is a collection of values. The arrows into, or out of, the expansion region, determine the specific type of expansion node.



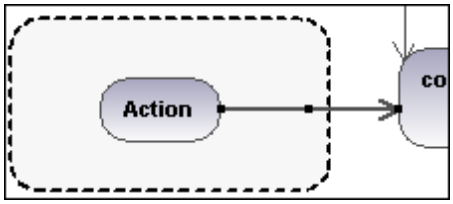
InterruptableActivityRegion

An interruptible region contains activity nodes. When a control flow leaves an interruptible region all flows and behaviors in the region are terminated.

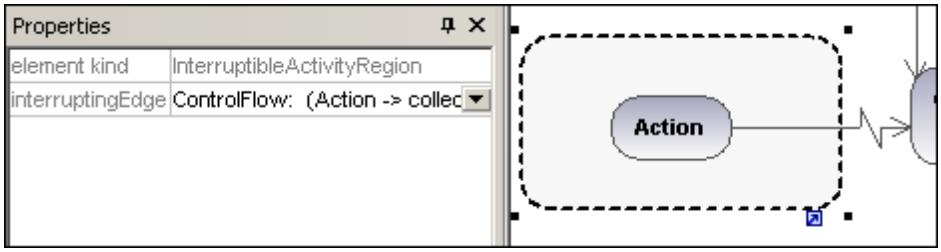
To add an interrupting edge:

Making sure that:

- an Action element is present in the InterruptableActivityRegion, as well as an outgoing Control Flow to another action:



1. Right click the Control Flow arrow, and select **New | InterruptingEdge**.



Please note:

You can also add an InterrupingEdge by clicking the InterruptableActivityRegion, right clicking in the Properties window, and selecting Add InterruptingEdge from the pop-up menu.

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9.1.2 State Machine Diagram

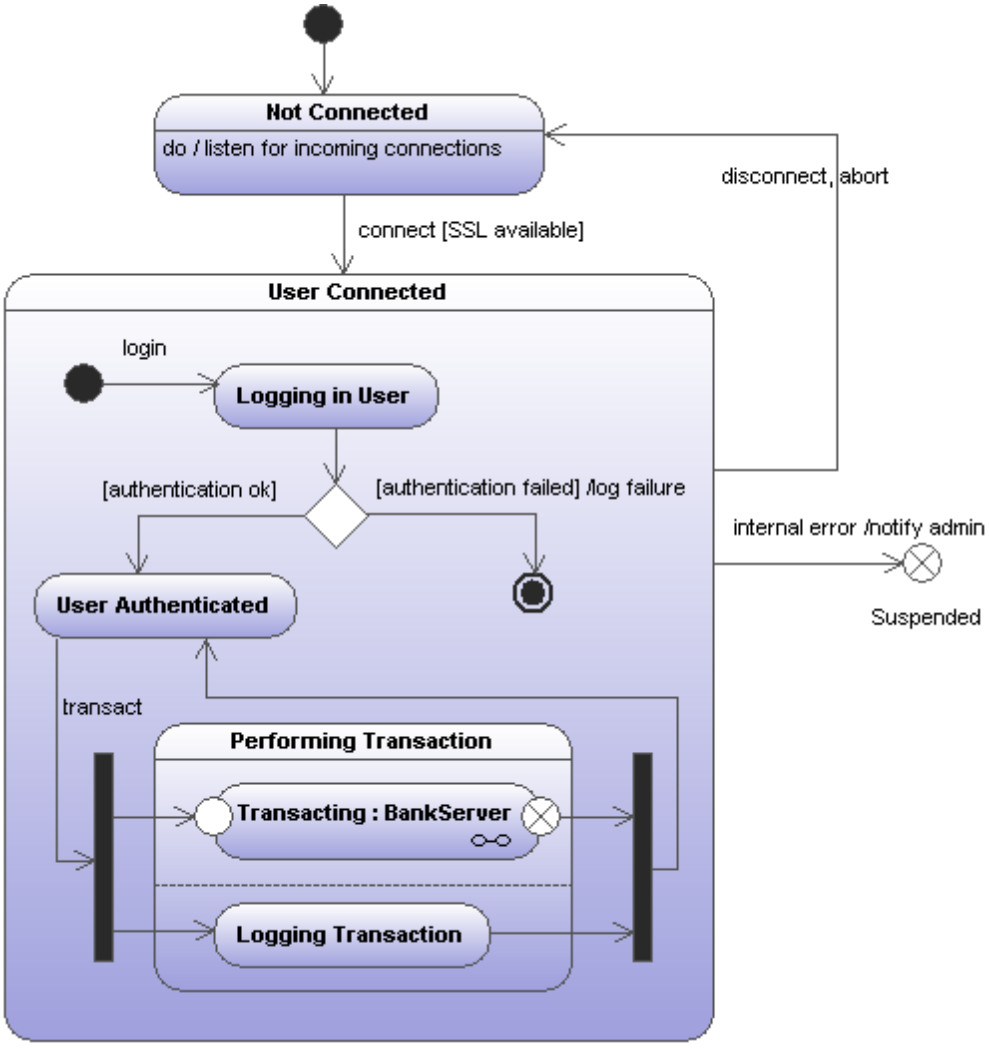
Altova web site: UML State Machine diagrams

The State Machine Diagram models the behavior of a system by describing the various states an object may be in, and the transitions between those states. They are generally used to describe the behavior of an object spanning several use cases. A state machine can have any number of State Machine Diagrams (or State Diagrams) UModel.

Two types of processes can achieve this:
Actions, which are associated to **transitions,** are short-term processes that cannot be interrupted. E.g. an initial transition, **internal error /notify admin**.

State **Activities** (behaviors), which are associated to **states,** are longer-term processes that may be interrupted by other events. E.g. **listen for incoming connections**.

Please note that the State machine diagrams shown in the following section are available in the **Bank_MultiLanguage**.ump sample, in the ...**UModelExamples** folder supplied with UModel.



Inserting state machine diagram elements

Using the toolbar icons:

1. Click the specific state machine diagram icon in the State Machine Diagram toolbar.

2. Click in the State Diagram to insert the element.
   Note that holding down CTRL and clicking in the diagram tab, allows you to insert multiple elements of the type you selected.

Dragging existing elements into the state machine diagram:

Most elements occurring in other state machine diagrams, can be inserted into an existing state machine.

1. Locate the element you want to insert in the Model Tree tab (you can use the search function text box, or press CTRL+F, to search for any element).
2. Drag the element(s) into the state diagram.

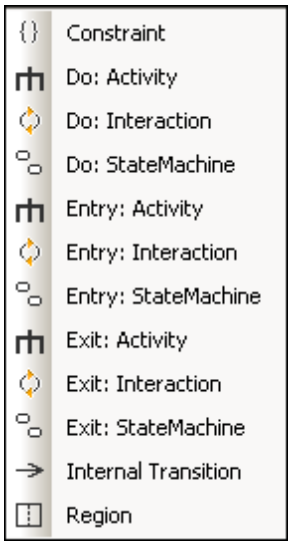
Creating states, activities and transitions

To add a simple state:

1. Click the **State** toolbar icon ( ) , and then click inside the diagram.
2. Enter the name of the state and press **Enter** to confirm.

To add an activity to a state:

- Right-click the state element, select **New**, and then one of the entries from the context menu.



The **Entry**, **Exit**, and **Do** activities are associated with one of the following possible behaviors: "Activity", "Interaction", and "StateMachine". Therefore, the options available in the context menu are:

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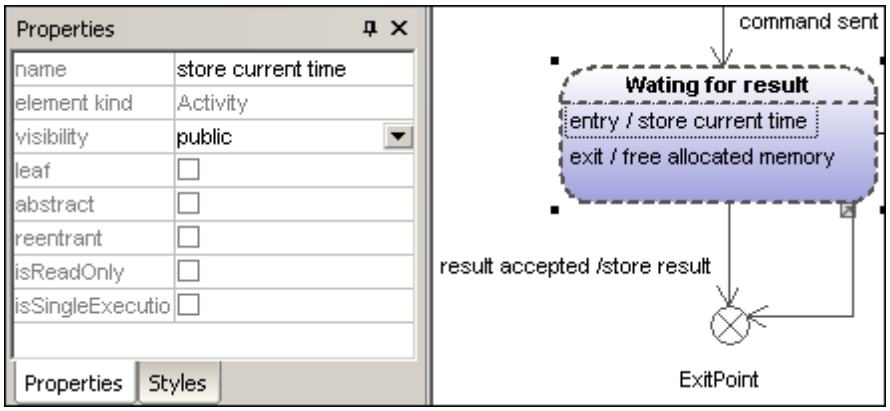
- Do: Activity
- Do: Interaction
- Do: StateMachine
- Entry: Activity
- Entry: Interaction
- Entry: StateMachine
- Exit: Activity
- Exit: Interaction
- Exit: StateMachine

These options originate in the UML specification. Namely, each of these internal actions are behaviors, and, in the UML specification, three classes derive from the "Behavior" class: Activity, StateMachine, and Interaction. In the generated code, it does not make a difference which particular behavior (Activity, StateMachine, or Interaction) has been selected.

You can select one action from the **Do**, **Entry** and **Exit** action categories. Activities are placed in their own compartment in the state element, though not in a separate region. The type of activity that you select is used as a prefix for the activity e.g. **entry / store current time**.

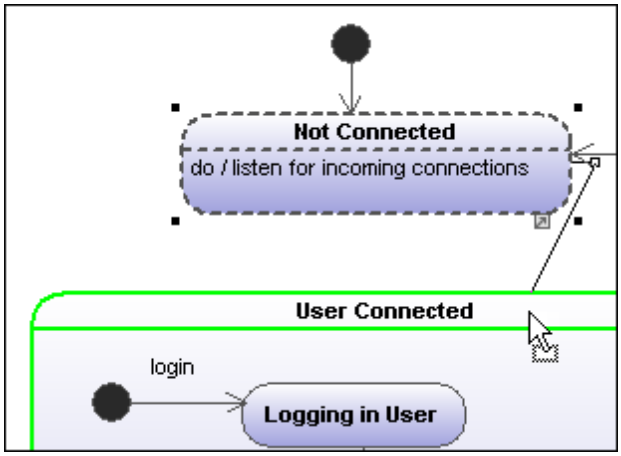


To delete an activity:

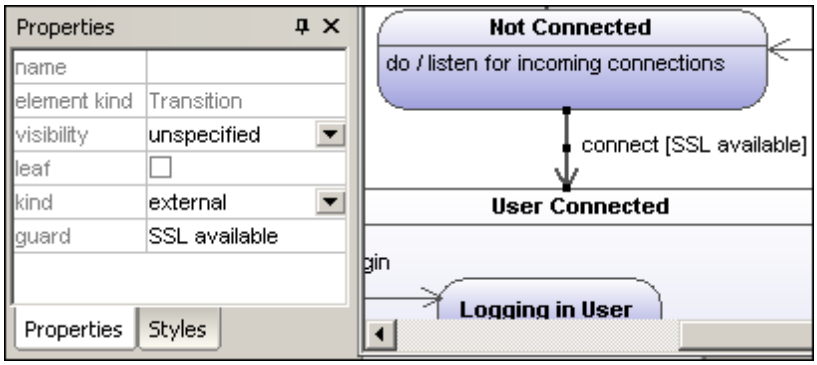
- Click the respective activity in the state element and press the Del. key.

To create a transition between two states:

1. Click the Transition handle of the source state (on the right of the element).
2. Drag-and-drop the transition arrow onto the target state.



The Transition properties are now visible in the Properties tab. Clicking the "kind" combo box, allows you to define the transition type: external, internal or local.



Transitions can have an event trigger, a guard condition and an action in the form **eventTrigger [guard condition] /activity**.

To automatically create operations from transitions:

Activating the "Toggle automatic creation of operations in target by typing operation names" icon , automatically creates the corresponding operation in the referenced class, when creating a transition and entering a name e.g. myOperation().

Note: operations can only be created automatically when the state machine is inside a class or interface.

To automatically create operations from activities:

1. Right click the State and select the specific action/activity, e.g. New | Entry:Activity.
2. Enter the name of the activity making sure to finish with the open/close brackets "**()**", e.g. **entry / OnEntryCooler()**.

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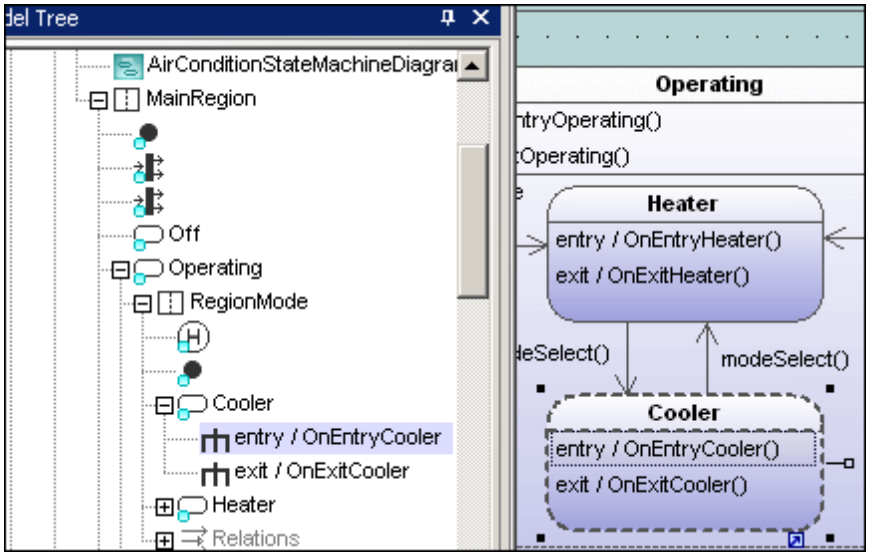
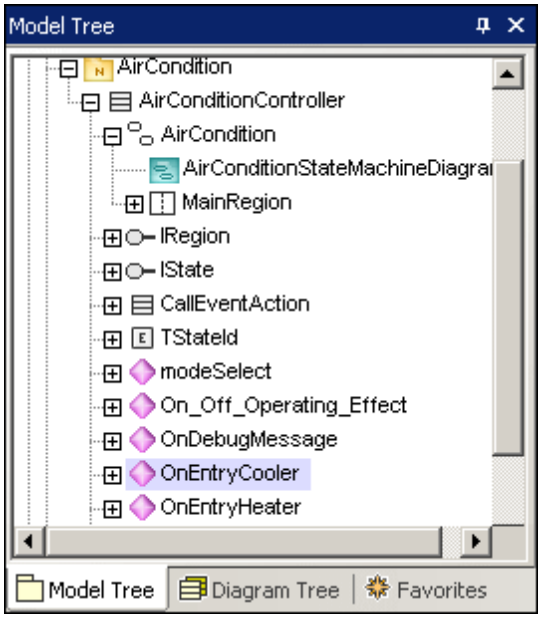
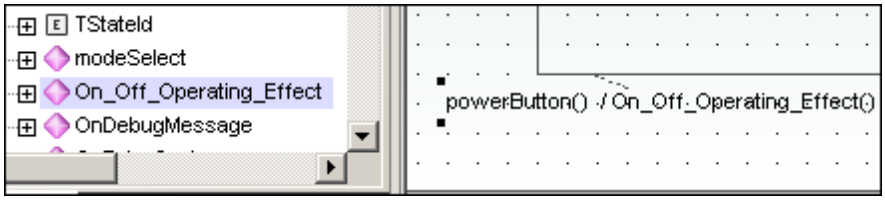


The new element is also visible in the Model Tree.
Scrolling down the Model Tree, you will notice that the OnEntryCooler operation has been added to the parent class AirConditionController.



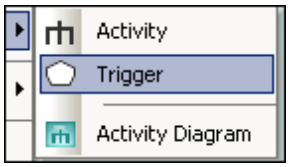
Please note:

Operations are automatically added for: Do:Activity, Entry:Activity, Exit:Activity, as well as guard condition activities and effects (on transitions).



To create a transition trigger:

1. Right click a previously created transition (arrow).
2. Select **New | Trigger**.



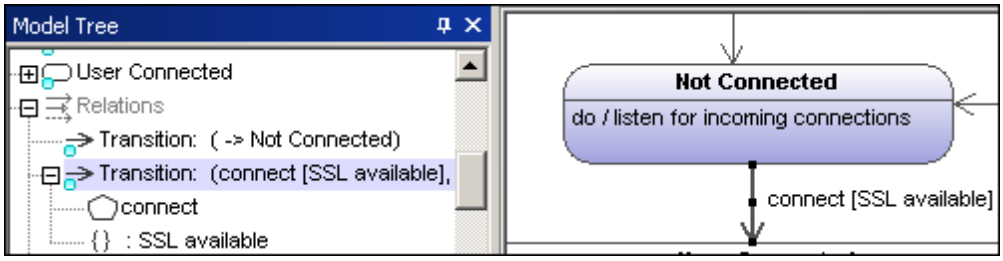
An "a" character appears in the transition label above the transition arrow, if it is the first trigger in the state diagram. Triggers are assigned default values of the form alphabetic letter, source state -> target state.

3. Double click the new character and enter the transition properties in the form **eventTrigger [guard condition] / activity**.

Transition property syntax; the text entered before the square brackets is the trigger, between brackets the guard condition, and after the slash, the activity. Manipulating this string automatically creates or deletes the respective elements in the Model Tree.

Please note:

To see the individual transition properties, right click the transition (arrow) and select "Select in Model Tree". The event, activity and constraint elements are all shown below the selected transition.



Adding an Activity diagram to a transition:

UModel has the unique capability of allowing you to add an Activity diagram to a transition, to describe the transition in more detail.

1. Right click a transition arrow in the diagram, and select **New | Activity Diagram**. This inserts an Activity diagram window into the diagram at the position of the transition arrow.
2. Click the inserted window to make it active. You can now use the scroll bars to scroll within the window.

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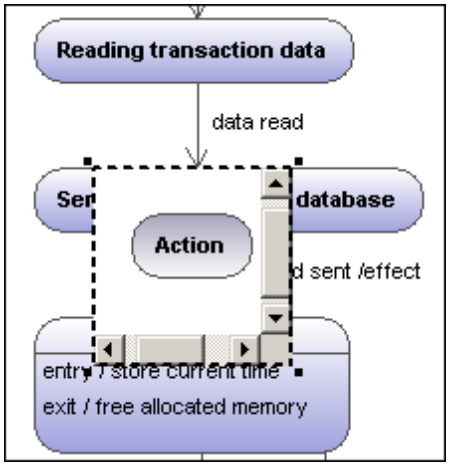
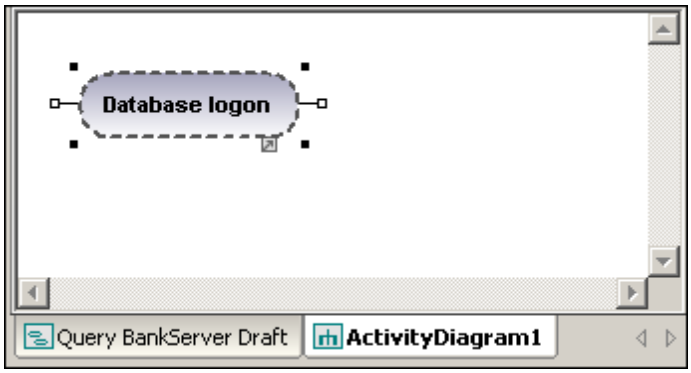
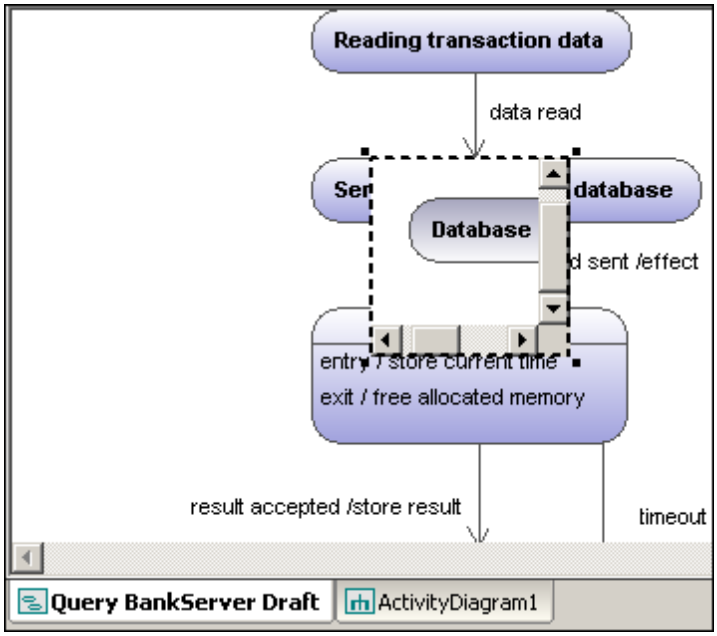


3. Double click the Action window to switch into the Activity diagram and further define the transition, e.g. change the Action name to "Database logon".

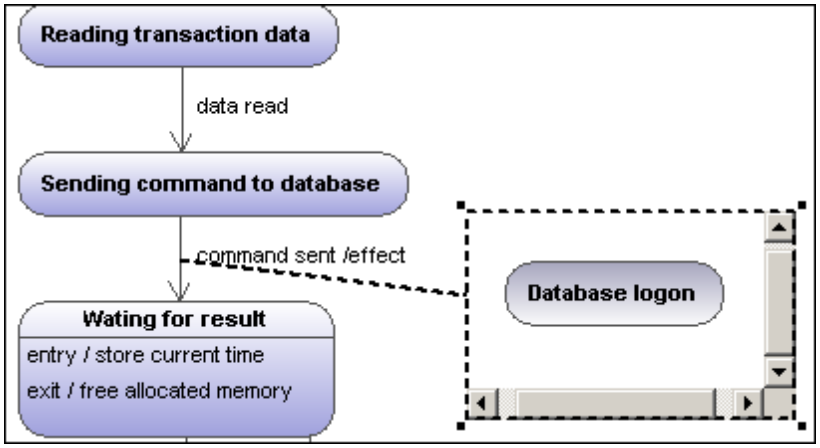


Note that a new Activity Diagram tab has now been added to the project. You can add any activity modeling elements to the diagram, please see "Activity Diagram" for more information.

4. Click the State Machine Diagram tab to switch back to see the update transition.



5. Drag the Activity window to reposition it in the diagram, and click the resize handle if necessary.



Dragging the Activity window between the two states, displays the transition in and out of the activity.

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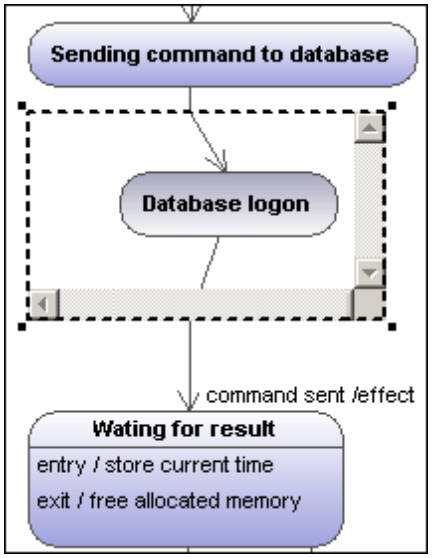


Composite states

Composite state

This type of state contains a second compartment comprised of a single region. Any number of states may be placed within this region.

To add a region to a composite state:

1. Right click the composite state and select **New | Region** from the context menu.
   A new region is added to the state. Regions are divided by dashed lines.

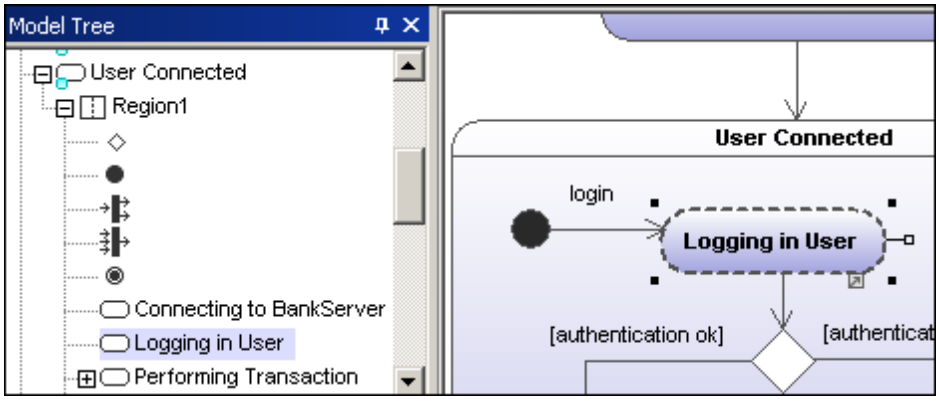
To delete a region:

1. Click the region you want to delete in the composite state and press the Del. key.
   Deleting a region of an orthogonal state reverts it back to a composite state; deleting the last region of a composite state changes it back to a simple state.

To place a state within a composite state:

1. Click the state element you want to insert (e.g. Logging in User), and drop it into the region compartment of the composite state.

   The region compartment is highlighted when you can drop the element. The inserted element is now part of the region, and appears as a child element of the region in the Model Tree pane.

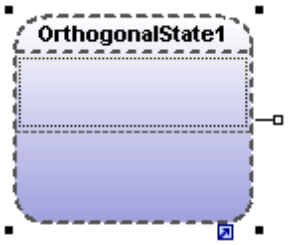


Moving the composite state moves all contained states along with it.

Orthogonal state

This type of state contains a second compartment comprised of two or more regions, where the separate regions indicate concurrency.

Right clicking a state and selecting **New | Region** allows you add new regions.



To show/hide region names:

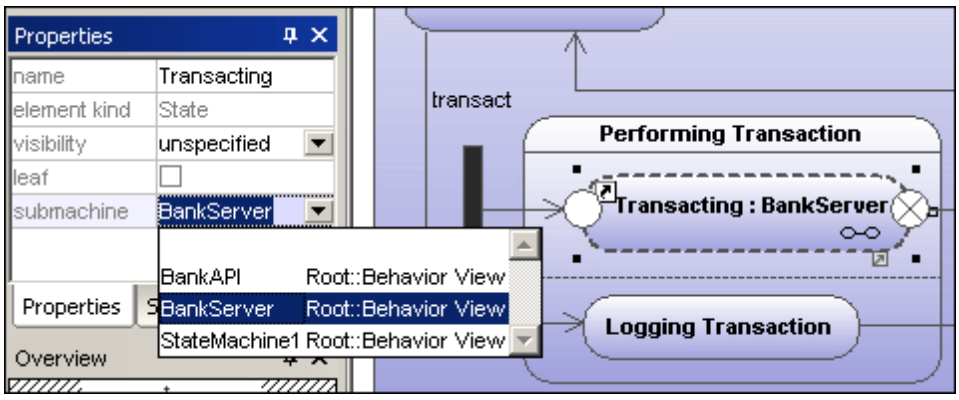
Click the Styles tab, scroll to the "Show region names on states" entry, and select true/false.

Submachine state

This state is used to hide details of a state machine. This state does not have any regions but is associated to a separate state machine.

To define a submachine state:

1. Having selected a state, click the **submachine** combo box in the Properties tab. A list containing the currently defined state machines appears.
2. Select the state machine that you want this submachine to reference.



Please note that a hyperlink icon automatically appears in the submachine, clicking it opens the referenced statemachine, BankServer in this case.

To add entry / exit points to a submachine state:

- The state which the point is connected to, must itself reference a submachine State Machine (visible in the Properties tab).
- This submachine must contain one or more Entry and Exit points

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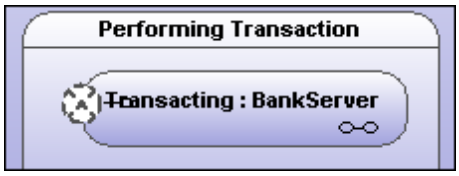
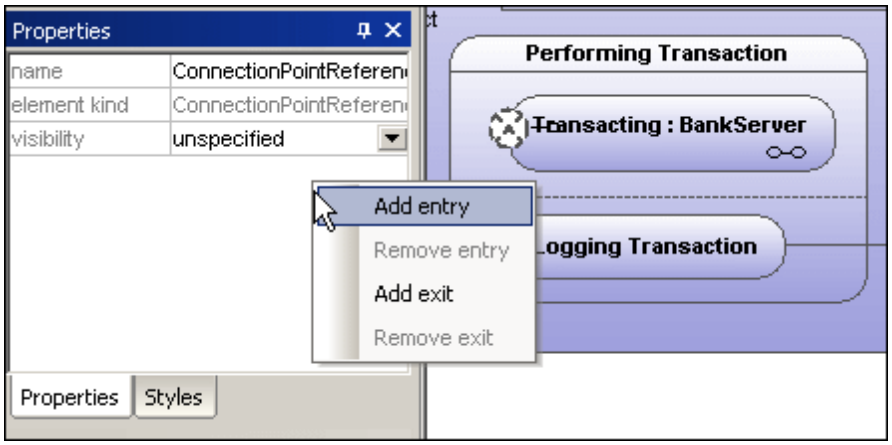
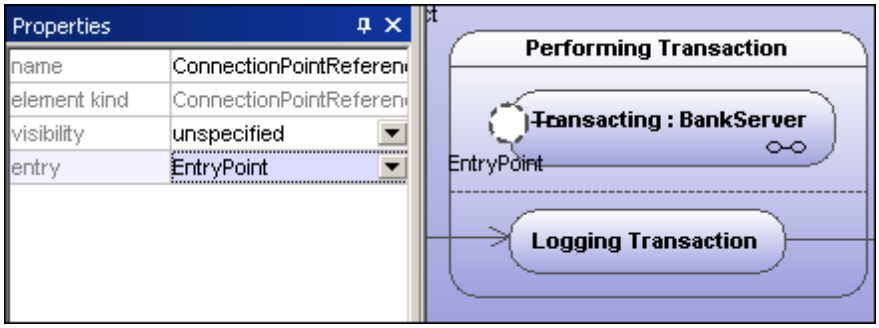
1. Click the **ConnectionPointReference** icon in the title bar, then click the submachine state that you want to add the entry/exit point to.



2. Right click in the Properties tab and select Add entry. Please note that another Entry, or Exit Point has to exist elsewhere in the diagram to enable this pop-up menu.



This adds an EntryPoint row to the Properties tab, and changes the appearance of the ConnectionPointReferece element.



3. Use the same method to insert an ExitPoint, by selecting "Add exit" from the context menu.

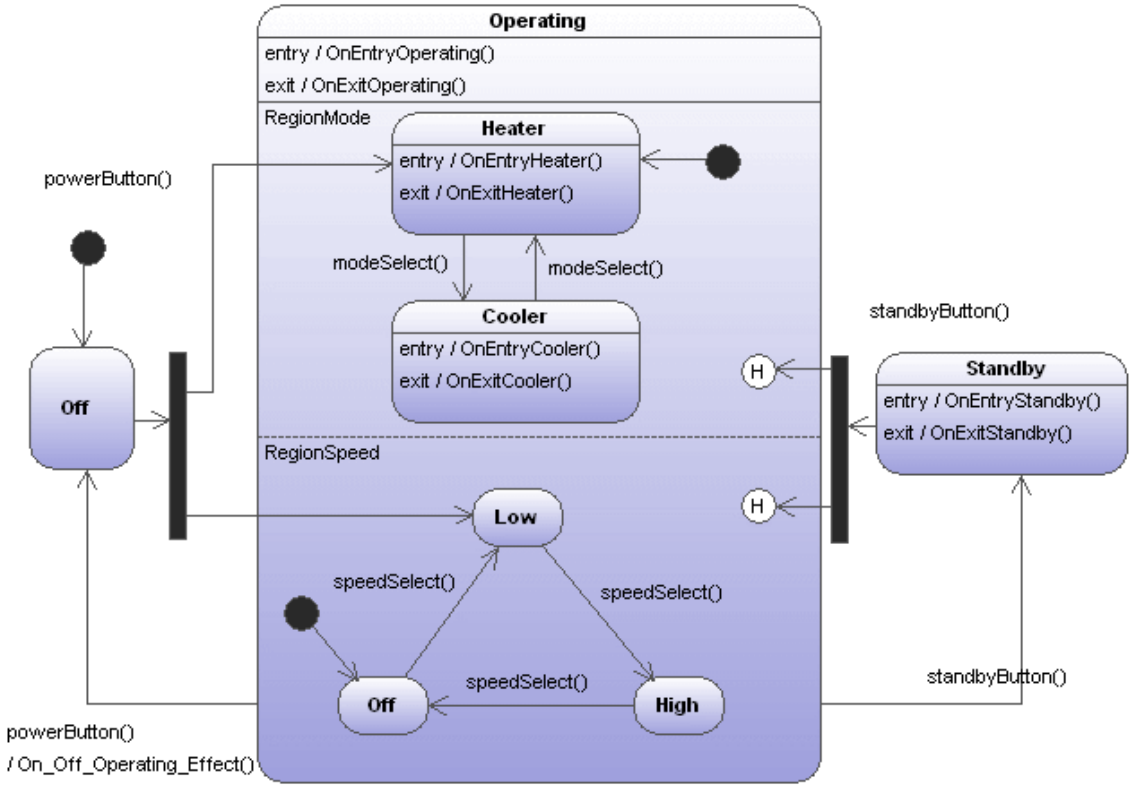
Code generation from State Machine diagrams

UModel is now able to generate executable code from State Machine diagrams (Java,VB.NET, or C#). Almost all of the State Machine diagram elements and features are supported:

- State
- CompositeState, with any hierarchical level
- OrthogonalState, with any number of regions
- Region
- InitialState
- FinalState
- Transition

- Guard
- Trigger
- Call-Event
- Fork
- Join
- Choice
- Junction
- DeepHistory
- ShallowHistory
- Entry/exit/do actions
- Effects

State Machine code generation is integrated into the "normal" round-trip engineering process. This means that State Machine code can be automatically updated on every forward-engineering process.



The screenshot above shows the AirCondition State Machine diagram which is available in the **..\StateMachineCodeGeneration** directory under **...\UModelExamples**. A separate directory exists for each of the code generation languages supported by UModel, i.e. C#, Java, and VB.

Each directory contains an AirCondition and Complex folder, which contains the respective UModel project, programming language project files, as well as the generated source files. The Complex.ump project file contains almost all of the modeling elements and functionality that UModel supports when generating code from State Machine diagrams.

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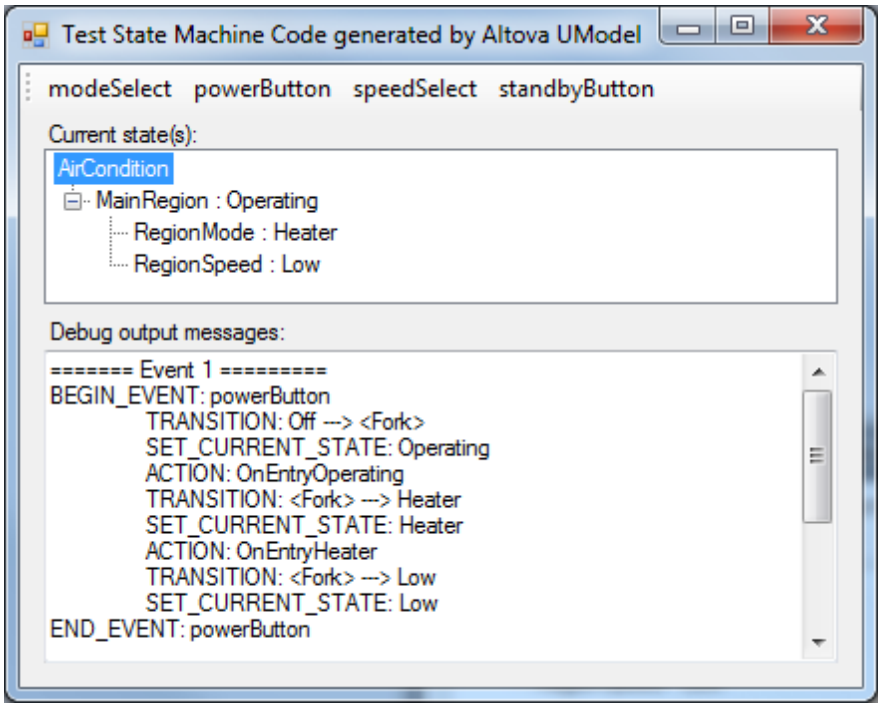
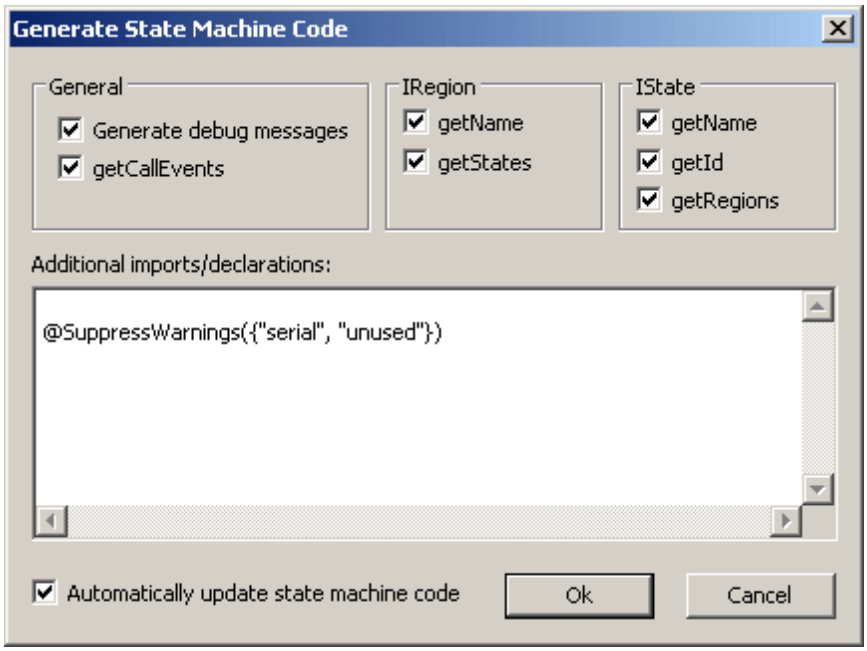
Each directory also contains a test application, e.g. TestSTMAirCondition.sln for C#, allowing you to work with the generated source files immediately.



To generate code from a State Machine diagram:

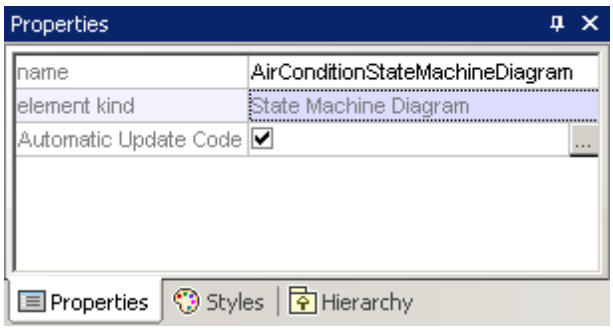
- **Right click** in the State Machine diagram and select "Generate State Machine code", or
- Select the menu option **Project | Generate State Machine Code**



The default settings are shown above. Click OK to generate the code.

State Machine code is automatically updated when you start the forward engineering process. You can however change this setting by clicking on the State Machine diagram background and clicking the "Automatic Update Code" check box.

Changes should not be made manually in the generated code, as these changes are not are not reflected in the State Machine diagram during the reverse-engineering process.



Clicking the ... icon of the Automatic Update field, opens the Generate State Machine Code dialog box, allowing you to change the code generation settings.

Please note:
You can perform a syntax check on a State Machine diagram by right clicking the diagram and selecting **Check State Machine Syntax.**

Working with state machine code

The parent class of the state machine (i.e. the "controller class", or "context class") is the one, and only, "interface" between the state machine user and the state machine implementation.

The controller class provides methods which can be used from "outside" to change the states (e.g. after external events occur).

The state machine implementation however, calls controller class methods ("callbacks") to inform the state machine user about state changes (OnEntry, OnExit, ...), transition effects, and the possibility to override and implement methods for conditions (guards).

UModel can automatically create simple operations (without any parameter) for entry/exit/do behaviors, transition effects, ... when the corresponding option is turned on (also see Creating states, activities and transitions). These methods can be changed to whatever you want in UModel (add parameters, set them as abstract, etc.).

A state machine (i.e. its controller class) can be instantiated several times. All instances work independently of each other.

- The UML State machine execution is designed for the "Run-to-completion execution model".
- UML state machines assume that processing of each event is completed before the next event is processed.
- This also means no entry/exit/do action or transition effect may directly trigger a new transition/state change.

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Initialization

- Every region of a state machine has to have an initial state.
- The code generated by UModel automatically initializes all regions of the state machine (or when the `Initialize()` method of the controller class is called).
- If OnEntry events are not wanted during initialization, you can call the `Initialize()` method manually and ignore OnEntry events during the startup.

Getting the current state(s)

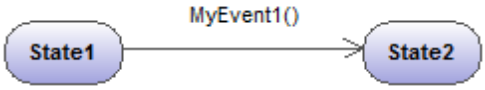
UModel supports composite states as well as orthogonal states, so there is not just one current state—every region (in any hierarchy level) can have one current state.

The AirCondition example shows how to walk through the regions to the current state(s):

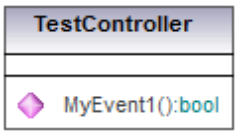
```
TreeNode rootNode = m_CurrentStateTree.Nodes.Add(m_STM.getRootState().getName());
UpdateCurrentStateTree(m_STM.getRootState(), rootNode);

private void UpdateCurrentStateTree(AirCondition.AirConditionController.IState
state, TreeNode node)
{
    foreach (AirCondition.AirConditionController.IRegion r in state.getRegions())
    {
        TreeNode childNode = node.Nodes.Add(r.getName() + " : " +
        r.getCurrentState().getName());
        UpdateCurrentStateTree(r.getCurrentState(), childNode);
    }
}
```

Example 1 - a simple transition



The corresponding operation is automatically generated in UModel

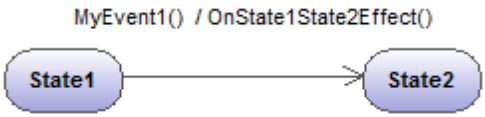


Generated method in code:

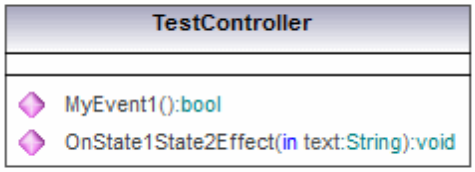
```
private class CTestStateMachine : IState
{
        …
        public bool MyEvent1()
        {
                …
        }
}
```

- The state machine user should call the generated method "MyEvent1" when the corresponding event occurs (outside the state machine).
- The return parameter of these event-methods provides information if the event caused a state change (i.e. if it had any effect on the state machine) or not. For example, if "State1" is active and event "MyEvent1()" occurs, the current state changes to "State2" and "MyEvent1()" returns true. If "State2" is active and "MyEvent1()" occurs, nothing changes in the state machine and MyEvent1() returns false.

Example 2 - a simple transition with an effect



The corresponding operation is automatically generated in UModel



Generated method in code:

```
private class CTestStateMachine : IState
{
        …
        // Override to handle entry/exit/do actions, transition effects,...:
        public virtual void OnState1State2Effect() {}
}
```

- "OnState1State2Effect()" will be called by the state machine implementation, whenever the transition between "State1" and "State2" is fired.
- To react to this effect, "OnState1State2Effect()" should be overridden in a derived class of "CTestStateMachine".
- "CTestStateMachine:: OnState1State2Effect()" can also be set to abstract, and you will get compiler errors until the method is overridden.
- When "OnState1State2Effect()" is not abstract, and the "Generate debug messages" option is active, UModel will generate following debug output:

```
// Override to handle entry/exit/do actions, transition
effects,...:
public virtual void OnState1State2Effect()
{OnDebugMessage("ACTION: OnState1State2Effect");}
```

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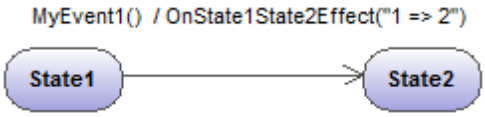
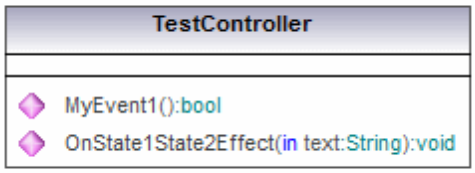
Example 3 - a simple transition with an effect and parameter



The corresponding operation is automatically generated in UModel

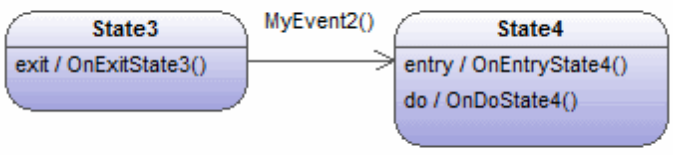


Generated method in code:

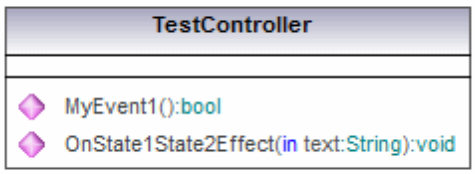
```
private class CTestStateMachine : IState
{
        …
        // Additional defined operations of the controller class:
        public virtual void OnState1State2Effect(String text)
        {
        }
}
```

- To effect operations (automatically created by UModel) parameters can be added manually (UModel cannot know the required type).
- In this sample, the parameter "text:String" has been added to the Effect method in TestController. A proper argument has to be specified when calling this method (here: "1 => 2").
- Another possibility would be: e.g. to call static methods ("MyStatic.OnState1State2Effect("1 => 2")"), or methods of singletons ("getSingleton().OnState1State2Effect("1 => 2")").

Example 4 - entry/exit/do actions



The corresponding operations are automatically generated in UModel



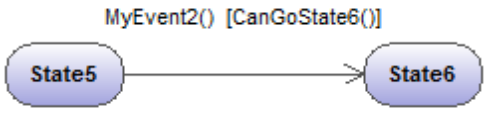
Generated method in code:

```
private class CTestStateMachine : IState
{
        …
        // Override to handle entry/exit/do actions, transition effects,...:
        public virtual void OnExitState3() {}
        public virtual void OnEntryState4() {}
        public virtual void OnDoState4() {}
}
```

- States can have entry/exit/do behaviors. UModel automatically creates the corresponding operations to handle them.
- When "MyEvent2()" occurs in the sample above, the state machine implementation calls "OnExitState3()", if "MyEvent2" would have an Effect, it would be subsequently called, then "OnEntryState4" and "OnDoState4" would be called.
- Normally, these methods should be overridden. When they are not abstract and the "Generate debug messages" option is active, UModel provides default debug output as described in Example 2.
- These methods can also have parameters as shown in Example 3.

Example 5 - guards

Transitions can have guards, which determine if the transition really can fire.



The corresponding operation is automatically generated in UModel

Generated method in code:

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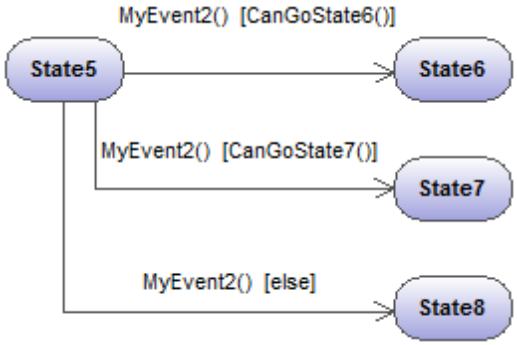
```
private class CTestStateMachine : IState
{
        …
        // Additional defined operations of the controller class:
        public virtual bool CanGoState6()
        {
            return true; // Override!
        }
}
```

- If "State5" is the active state and "MyEvent2" occurs, the state machine implementation will call "CanGoState6" and, depending on its result, the transition will fire or not.
- Normally, these methods should be overridden. When they are not abstract and the "Generate debug messages" option is active, UModel provides default debug output as described in Example 2.
- These methods also can have parameters as shown in Example 3.
- Multiple transitions with the same event, but having different guards, are possible. The order in which the different guards are polled is undefined. If a transition does not have a guard, or the guard is "else", it will be considered as the last (i.e., only when all other transition guards return false, will this one will fire). For example, in the diagram below, it is undefined whether `CanGoState6()` or `CanGoState7()` is called first. The third transition will only fire if `CanGoState6()` and `CanGoState7()` return false.



Additional constructs and functionality can be found in the **AirCondition.ump** and **Complex.ump** samples.

State Machine Diagram elements

InitialState (pseudostate)
The beginning of the process.

FinalState
The end of the sequence of processes.

EntryPoint (pseudostate)
The entry point of a state machine or composite state.

ExitPoint (pseudostate)

The exit point of a state machine or composite state.

Choice
This represents a dynamic conditional branch, where mutually exclusive guard triggers are evaluated (OR operation).

Junction (pseudostate)
This represents an end to the OR operation defined by the Choice element.

Terminate (pseudostate)
The halting of the execution of the state machine.

Fork (pseudostate)
Inserts a vertical Fork bar.
Used to divide sequences into concurrent subsequences.

Fork horizontal (pseudostate)
Inserts a horizontal Fork bar.
Used to divide sequences into concurrent subsequences.

Join (pseudostate)
Joins/merges previously defined subsequences. All activities have to be completed before progress can continue.

Join horizontal (pseudostate)
Joins/merges previously defined subsequences. All activities have to be completed before progress can continue.

DeepHistory
A pseudostate that restores the previously active state within a composite state.

ShallowHistory
A pseudostate that restores the initial state of a composite state.

All pseudostate elements can be changed to a different "type", by changing the **kind** combo box entry in the Properties tab.

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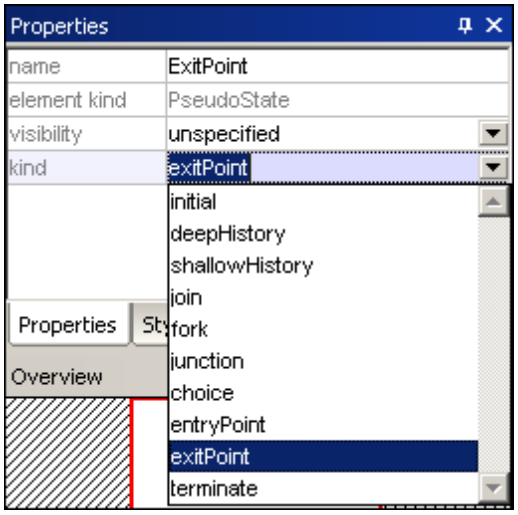


ConnectionPointReference
A connection point reference represents a usage (as part of a submachine state) of an entry/exit point defined in the
statemachine reference by the submachine state.

To add Entry or Exit points to a connection point reference:

- The state which the point is connected to, must itself reference a submachine State Machine (visible in the Properties tab).
- This submachine must contain one or more Entry and Exit points

Transition
A direct relationship between two states. An object in the first state performs one or more actions and then enters the second state depending on an event and the fulfillment of any guard conditions.

Transitions have an event trigger, guard condition(s), an action (behavior), and a target state.

Supported event subelements are:

- ReceiveSignalEvent, SignalEvent, SendSignalEvent, ReceiveOperationEvent, SendOperationEvent and ChangeEvent.

Toggle automatic creation of operations in target by typing operation names

Activating the "Toggle automatic creation of operations in target by typing operation names" icon, automatically creates the corresponding operation in the referenced class, when creating a transition and entering a name myOperation().

Note: operations can only be created automatically when the state machine is inside a class or interface.

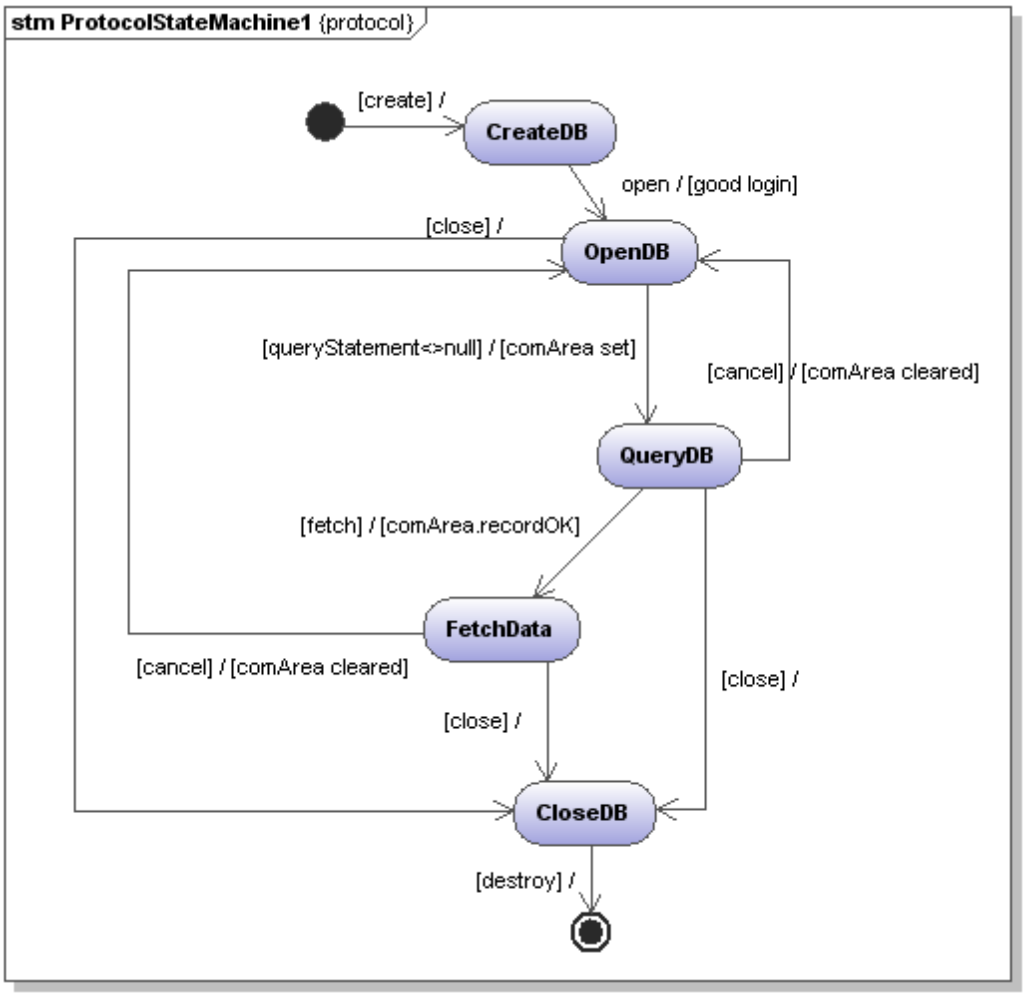
9.1.3 Protocol State Machine

Altova web site: UML Protocol State Machine diagrams

Protocol State Machines are used to show a **sequence** of events that an object responds to, without having to show the specific behavior. The required sequence of events, and the resulting changes in the state of the object, are modeled in this diagram.

Protocol State Machines are most often used to describe complex protocols, e.g. database access through a specific interface, or communication protocols such as TCP/IP.

Protocol State Machines are created in the same way as State Machine diagrams, but have fewer modeling elements. Protocol-Transitions between states can have pre- or post conditions which define what must be true for a transition to another state to occur, or what the resulting state must be, once the transition has taken place.



Inserting Protocol State Machine elements

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Using the toolbar icons:

1. Click the Protocol State Machine icon in the toolbar.
2. Click in the Protocol State Machine Diagram to insert the element.
   Note that holding down CTRL and clicking in the diagram tab, allows you to insert multiple elements of the type you selected.

Dragging existing elements into the Protocol State Machine diagram:

Most elements occurring in other Protocol State Machine diagrams, can be inserted into an existing diagram.

1. Locate the element you want to insert in the Model Tree tab (you can use the search function text box, or press CTRL+F, to search for any element).
2. Drag the element(s) into the Protocol State Machine diagram.

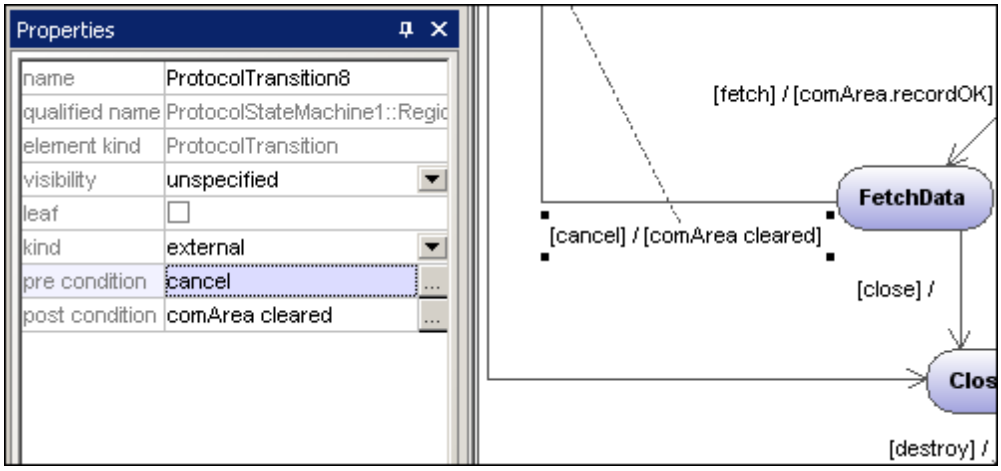
To insert a simple state:

1. Click the State icon in the icon bar and click in the Protocol State Machine diagram to insert it.
2. Enter the name of the state and press Enter to confirm.
   Simple states do not have any regions or any other type of substructure.

To create a Protocol Transition between two states:

1. Click the Transition handle of the source state (on the right of the element), or use the Protocol Transition icon in the icon bar.
2. Drag-and-drop the transition arrow onto the target state.
   The text cursor is automatically set for you to enter the pre and/or post condition. Please make sure to use the square brackets [] and slash character when entering the conditions directly.

   Entering the pre/post conditions in the Properties window, automatically inserts the square brackets and slash character in the diagram.



To create and insert composite state elements and submachine states:

- Please see Composite states

Protocol State Machine Diagram elements

State
A simple state element with one compartment.

Composite state
This type of state contains a second compartment comprised of a single region. Any number of states may be placed within this region.

Orthogonal state
This type of state contains a second compartment comprised of two or more regions, where the separate regions indicate concurrency.

Right clicking a state and selecting **New | Region** allows you add new regions.

Submachine state
This state is used to hide details of a state machine. This state does not have any regions but is associated to a separate state machine.

InitialState (pseudostate)
The beginning of the process.

FinalState
The end of the sequence of processes.

EntryPoint (pseudostate)
The entry point of a state machine or composite state.

ExitPoint (pseudostate)
The exit point of a state machine or composite state.

Choice
This represents a dynamic conditional branch, where mutually exclusive guard triggers are evaluated (OR operation).

Junction (pseudostate)
This represents an end to the OR operation defined by the Choice element.

Terminate (pseudostate)
The halting of the execution of the state machine.

Fork (pseudostate)
Inserts a vertical Fork bar.

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Used to divide sequences into concurrent subsequences.

Fork horizontal (pseudostate)
Inserts a horizontal Fork bar.
Used to divide sequences into concurrent subsequences.

Join (pseudostate)
Joins/merges previously defined subsequences. All activities have to be completed before progress can continue.

Join horizontal (pseudostate)
Joins/merges previously defined subsequences. All activities have to be completed before progress can continue.

ConnectionPointReference
A connection point reference represents a usage (as part of a submachine state) of an entry/exit point defined in the
statemachine reference by the submachine state.

To add Entry or Exit points to a connection point reference:

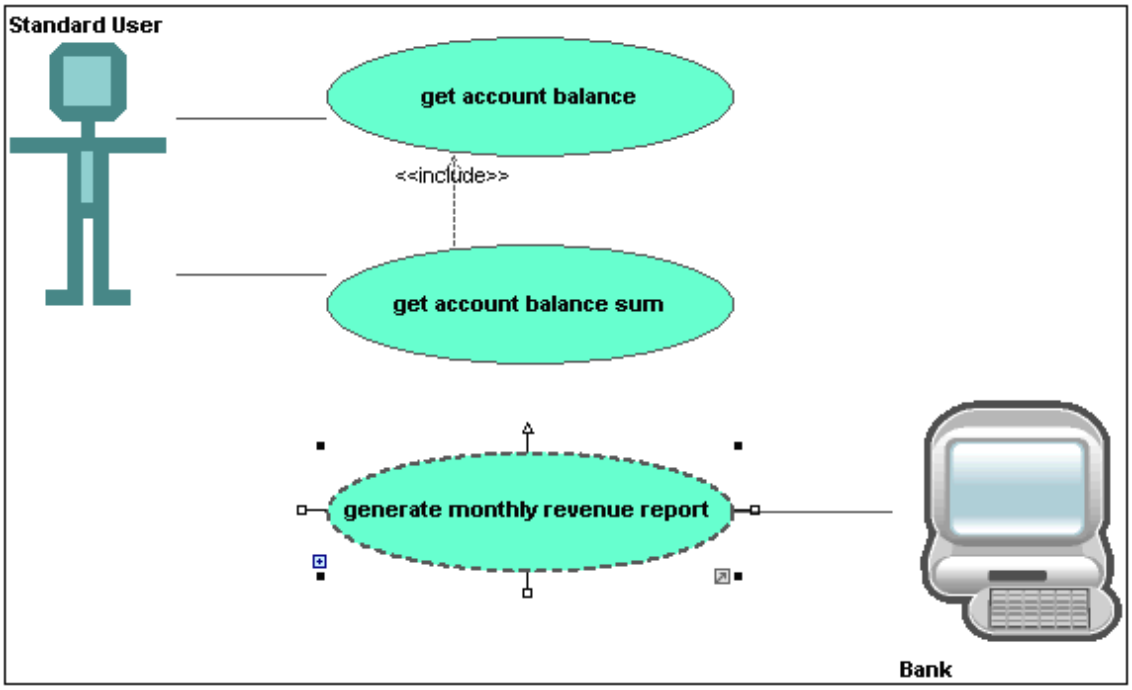
- The state which the point is connected to, must itself reference a submachine State Machine (visible in the Properties tab).
- This submachine must contain one or more Entry and Exit points

Protocol Transition
A direct relationship between two states. An object in the first state performs one or more operations and then enters the second state depending on an event and the fulfillment of any pre- or post conditions.

Please see Inserting Protocol State Machine elements for more information.

9.1.4 Use Case Diagram

Please see the Use Cases section in the tutorial for more information on how to add use case elements to the diagram.



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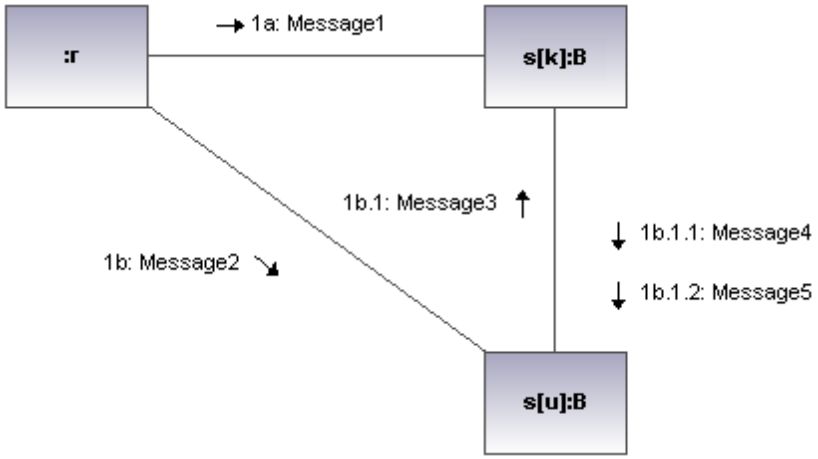
9.1.5 Communication Diagram

Altova web site: UML Communication diagrams

Communication diagrams display the interactions i.e. message flows, between objects at run-time, and show the relationships between the interacting objects. Basically, they model the dynamic behavior of use cases.

Communication diagrams are designed in the same way as sequence diagrams, except that the notation is laid out in a different format. Message numbering is used to indicate message sequence and nesting.

UModel allows you to generate Communication diagrams from Sequence diagrams and vice versa, in one simple action see "Generating Sequence diagrams" for more information.



Inserting Communication Diagam elements

Using the toolbar icons:

1. Click the specific communication icon in the Communication Diagram toolbar.

2. Click in the Communication diagram to insert the element.
   Note that holding down CTRL and clicking in the diagram tab, allows you to insert multiple elements of the type you selected.

Dragging existing elements into the Communication Diagram:
Elements occurring in other diagrams, e.g. classes, can be inserted into a Communication diagram.

1. Locate the element you want to insert in the Model Tree tab (you can use the search function text box, or press CTRL+F, to search for any element).
2. Drag the element(s) into the Communication diagram.

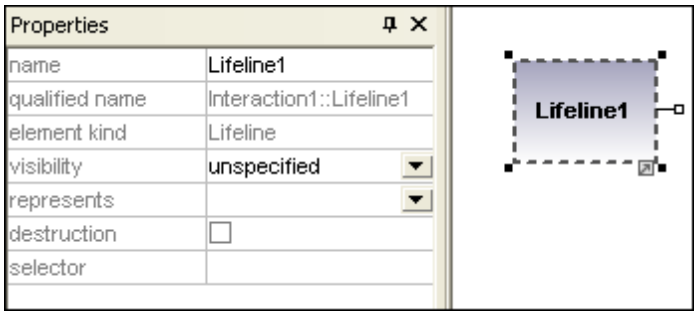
Lifeline

The lifeline element is an individual participant in an interaction. UModel allows you to insert other elements into the sequence diagram, e.g. classes. Each of these elements then appear as a new lifeline. You can redefine the lifeline colors/gradient using the "Header Gradient" combo boxes in the Styles tab.

To create a **multiline** lifeline press **CTRL+Enter** to create a new line.

To insert a Communication lifeline:

1. Click the Lifeline icon in the title bar, then click in the Communication diagram to insert it.



2. Enter the lifeline name to change it from the default name, Lifeline1, if necessary.

Messages

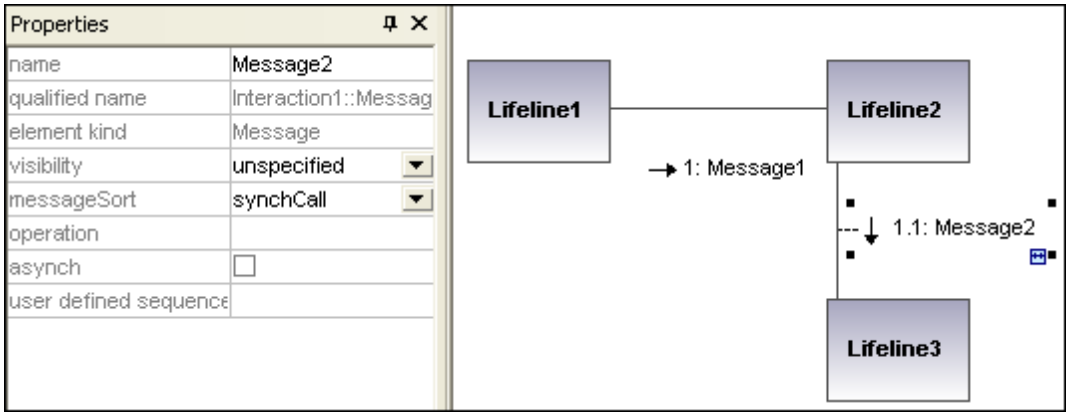
A Message is a modeling element that defines a specific kind of communication in an interaction. A communication can be e.g. raising a signal, invoking an Operation, creating or destroying an instance. The message specifies the type of communication as well as the sender and the receiver.

Message (Call) Message (Reply) Message (Creation) Message (Destruction)

To insert a message:

1. Click the specific message icon in the toolbar.
2. Drag and drop the message line onto the receiver objects.

   Lifelines are highlighted when the message can be dropped.



Note: holding down the CTRL key allows you to insert a message with each click.

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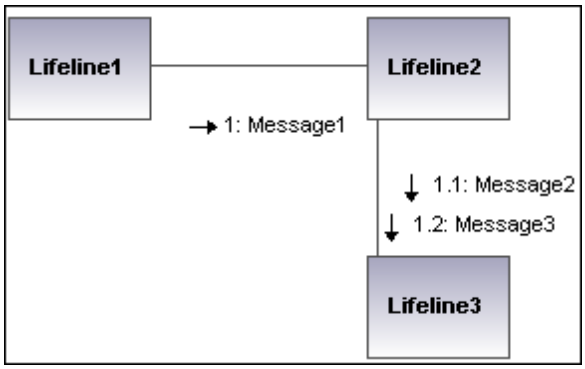
To insert additional messages:

1. Right click an existing communication link and select **New | Message**.



- The direction in which you drag the arrow defines the message direction. Reply messages can point in either direction.
- Having clicked a message icon and holding down CTRL, allows you to insert multiple messages by repeatedly clicking and dragging in the diagram tab.

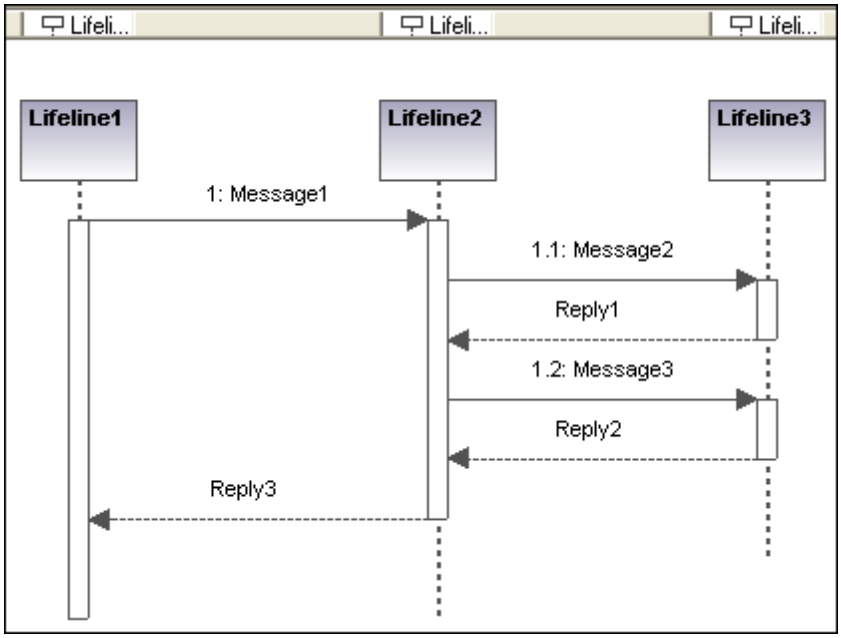
Message numbering

The Communication diagram uses the decimal numbering notation, which makes it easy to see the hierarchical structure of the messages in the diagram. The sequence is a dot-separated list of sequence numbers followed by a colon and the message name.

Generating Sequence diagrams from Communication diagrams:

UModel allows you to generate Communication diagrams from Sequence diagrams and vice versa, in one simple action:

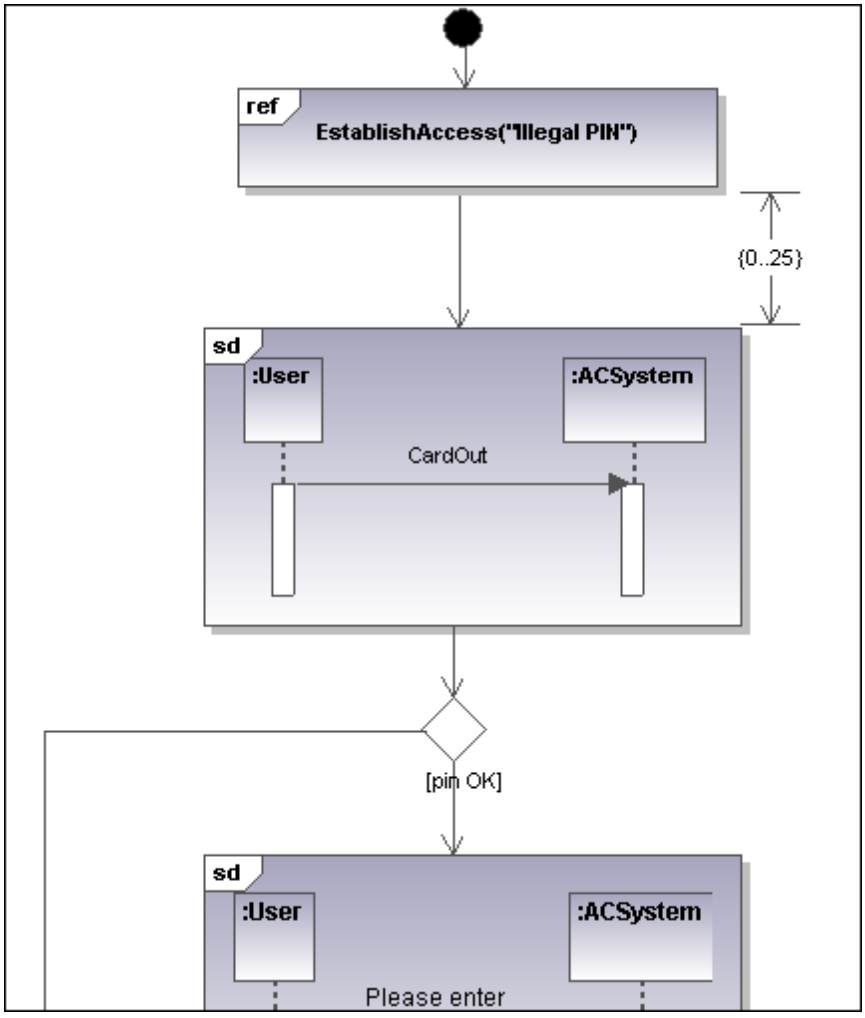
- Right click anywhere in a Communication diagram and select **Generate Sequence Diagram** from the context menu.



9.1.6 Interaction Overview Diagram

Altova web site: UML Interaction Overview diagrams

Interaction Overview Diagrams are a variant of Activity diagrams and give an overview of the interaction between other interaction diagrams such as Sequence, Activity, Communication, or Timing diagrams. The method of constructing a diagram is similar to that of Activity diagram and uses the same modeling elements: start/end points, forks, joins etc.



Two types of interaction elements are used instead of activity elements: Interaction elements and Interaction use elements.

Interaction elements are displayed as iconized versions of a Sequence, Communication, Timing, or Interaction Overview diagram, enclosed in a frame with the "SD" keyword displayed in the top-left frame title space.

Interaction occurrence elements are references to existing Interaction diagrams with "Ref" enclosed in the frame's title space, and the occurrence's name in the frame.

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Inserting Interaction Overview elements

Using the toolbar icons:

1. Click the specific icon in the Interaction Overview Diagram toolbar.

2. Click in the diagram to insert the element.
   Note that holding down CTRL and clicking in the diagram tab, allows you to insert multiple elements of the type you selected.

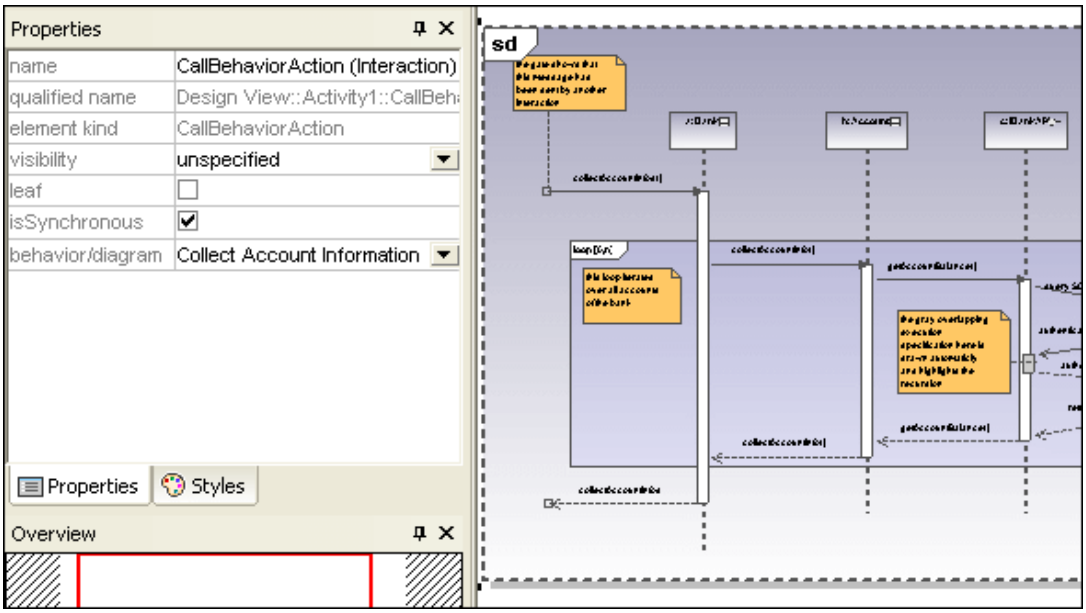
Dragging existing elements into the Interaction Overview Diagram:

Elements occurring in other diagrams, e.g. Sequence, Activity, Communication, or Timing diagrams can be inserted into a Interaction Overview diagram.

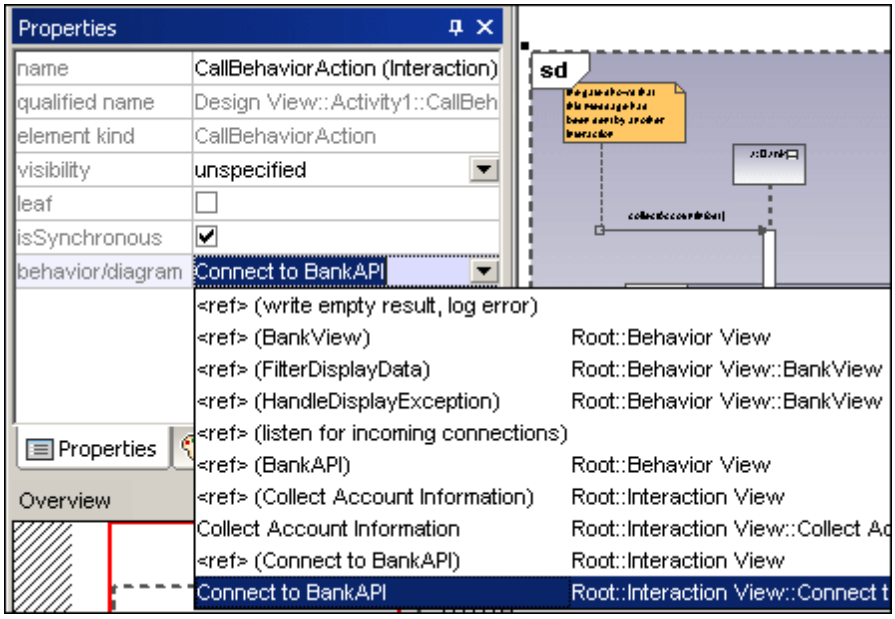
1. Locate the element you want to insert in the Model Tree tab (you can use the search function text box, or press CTRL+F, to search for any element).
2. Drag the element(s) into the diagram.

Inserting an Interaction element:

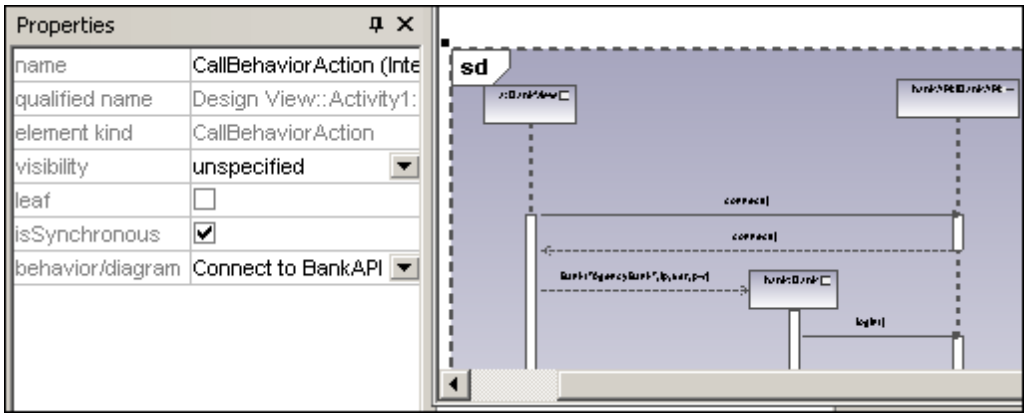
1. Click the CallBehaviorAction (Interaction) icon in the icon bar, and click in the Interaction Overview diagram to insert it.



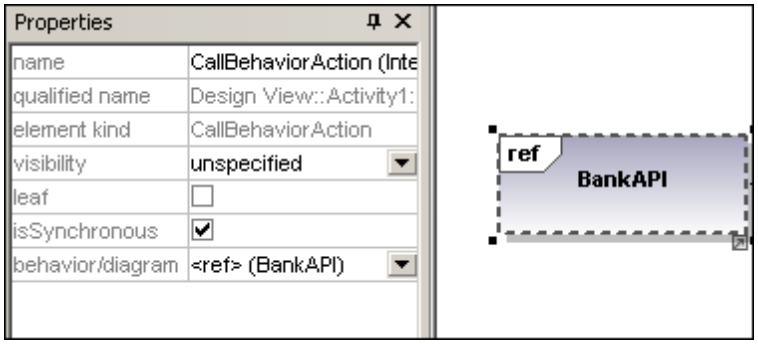
   The Collect Account Information sequence diagram is automatically inserted if you are using the Bank_Multilanguage.ump example file from the ...**UModelExamples** folder. The first sequence diagram, found in the model tree, is selected per default.
2. To change the default interaction element: Click the **behavior/diagram** combo box in the Properties tab.
   A list of all the possible elements that can be inserted is presented.



3. Click the element you want to insert to e.g. Connect to BankAPI.



As this is also a sequence diagram, the Interaction element appears as an iconized version of the sequence diagram.
If you select **<ref> BankAPI**, then the Interaction element occurrence is displayed.



Inserting an Interaction element occurrence:

1. Click the CallBehaviorAction (InteractionUse) icon in the icon bar, and click in the Interaction Overview diagram to insert it.

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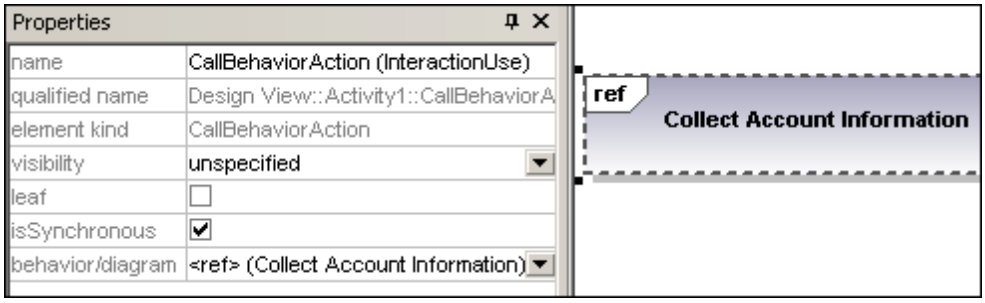
Collect Account Information is automatically inserted as a Interaction occurrence element, if you are using the Bank_Multilanguage.ump example file from the ... **UModelExamples** folder. The first existing sequence diagram is selected per default.



2. To change the Interaction element: double click the **behavior** combo box in the Properties tab.
   A list of all the possible elements that can be inserted is presented.
3. Select the occurrence you want to insert.
   Note that all elements inserted using this method appear in the form shown in the screenshot above i.e. with "**ref**" in the frame's title space.

DecisionNode
Inserts a Decision Node which has a single incoming transition and multiple outgoing guarded transitions. Please see "Creating a branch" for more information.

MergeNode
Inserts a Merge Node which merges multiple alternate transitions defined by the Decision Node. The Merge Node does not synchronize concurrent processes, but selects one of the processes.

InitialNode
The beginning of the activity process. An interaction can have more than one initial node.

ActivityFinalNode
The end of the interaction process. An interaction can have more that one final node, all flows stop when the "first" final node is encountered.

ForkNode
Inserts a vertical Fork node.
Used to divide flows into multiple concurrent flows.

ForkNode (Horizontal)
Inserts a horizontal Fork node.
Used to divide flows into multiple concurrent flows.

JoinNode
Inserts a vertical Fork node.

A Join node synchronizes multiple flows defined by the Fork node.

Join Node (horizontal)
Inserts a horizontal Fork node.
A Join node synchronizes multiple flows defined by the Fork node.

AddDurationConstraint
A Duration defines a ValueSpecification that denotes a duration in time between a start and endpoint. A duration is often an expression representing the number of clock ticks, which may elapse during this duration.

ControlFlow
A Control Flow is an edge, i.e. an arrowed line, that connects two behaviours, and starts an interaction after the previous one has been completed.

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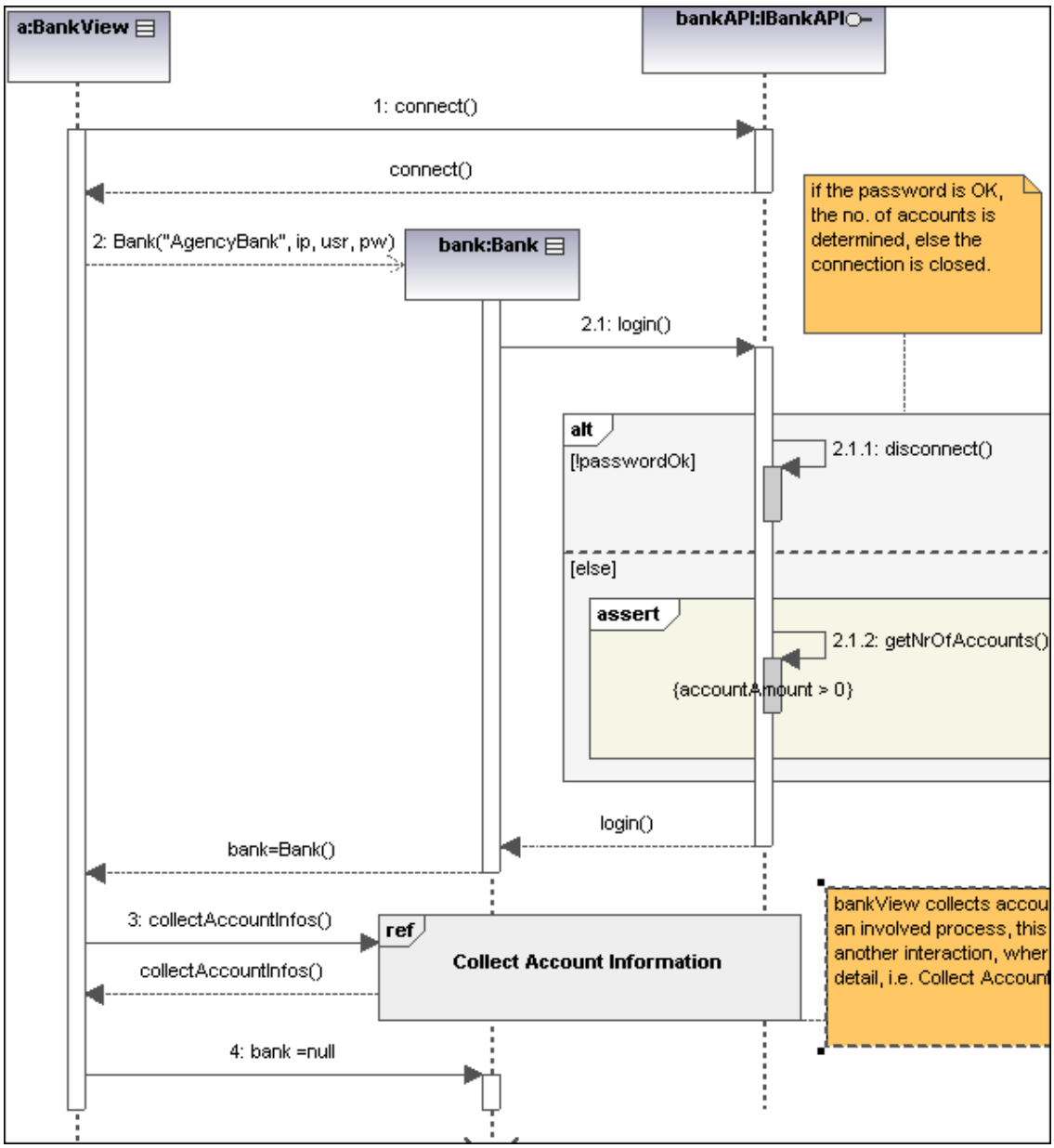
9.1.7 Sequence Diagram

Altova web site: UML Sequence diagrams

UModel supports the standard Sequence diagram defined by UML, and allows easy manipulation of objects and messages to model use case scenarios. Please note that the sequence diagrams shown in the following sections are only available in the **Bank_Java**.ump, **Bank_CSharp**.ump and **Bank_MultiLanguage**.ump samples, in the ...**UModelExamples** folder supplied with UModel.

Note: It is now possible to generate a sequence diagram directly from source code, please see Sequence Diagram diagram generation .



Inserting sequence diagram elements

A sequence diagram models runtime dynamic object interactions, using messages. Sequence diagrams are generally used to explain individual use case scenarios.

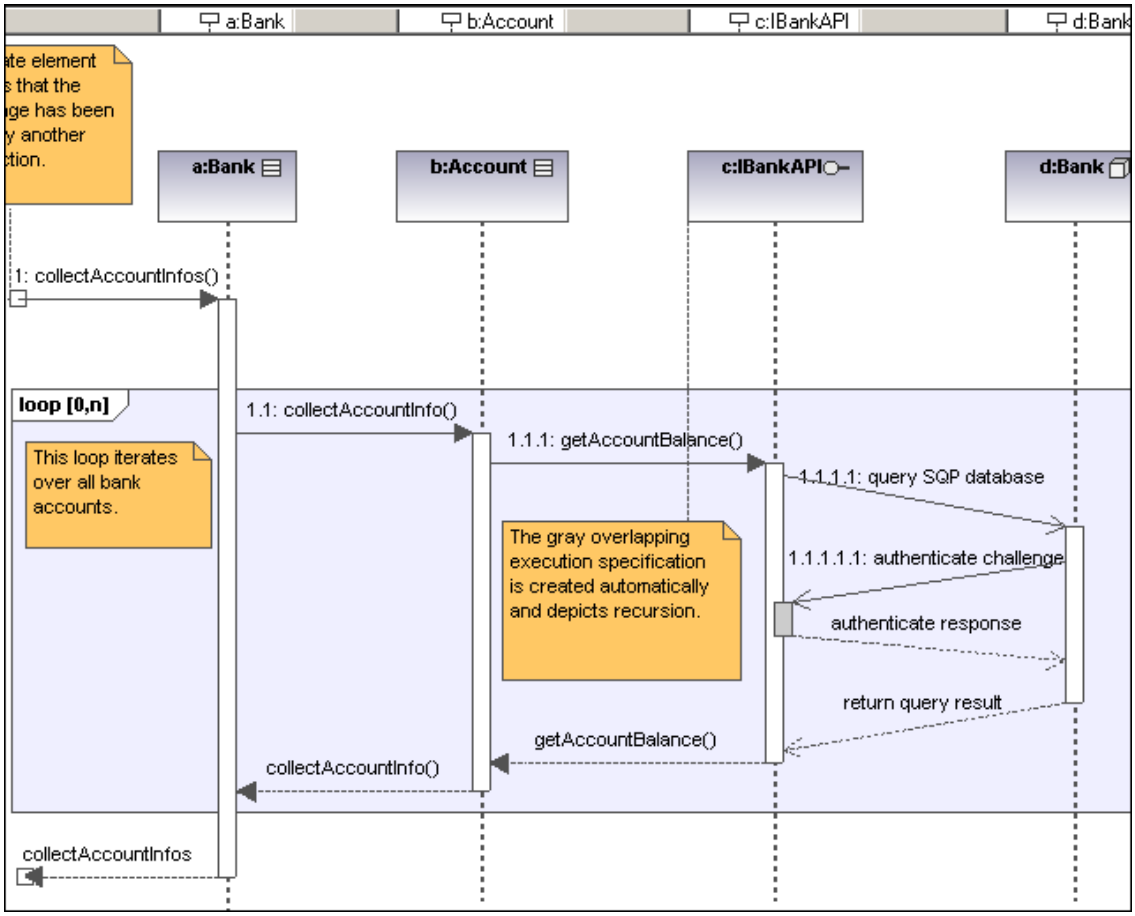
- **Lifelines** are the horizontally aligned boxes at the top of the diagram, together with a dashed vertical line representing the object's life during the interaction. Messages are shown as arrows between the lifelines of two or more objects.

- **Messages** are sent between sender and receiver objects, and are shown as labeled arrows. Messages can have a sequence number and various other optional attributes: argument list etc. Conditional, optional, and alternative messages are all supported. Please see Combined Fragment for more information.

Please see the following topics for more information:

Lifeline
Combined Fragment
Interaction Use
Gate
State Invariant
Messages

Sequence diagram and other UModel elements, can be inserted into a sequence diagram using several methods.



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Using the toolbar icons:

1. Click the specific sequence diagram icon in the Sequence Diagram toolbar.
2. Click in the Sequence diagram to insert the element.
   Note that holding down CTRL and clicking in the diagram tab, allows you to insert multiple elements of the type you selected.

Dragging existing elements into the sequence diagram:

Most classifier types, as well as elements occurring in other sequence diagrams, can be inserted into an existing sequence diagram.

1. Locate the element you want to insert in the Model Tree tab (you can use the search function text box, or press CTRL+F, to search for any element).
2. Drag the element(s) into the sequence diagram.

Lifeline

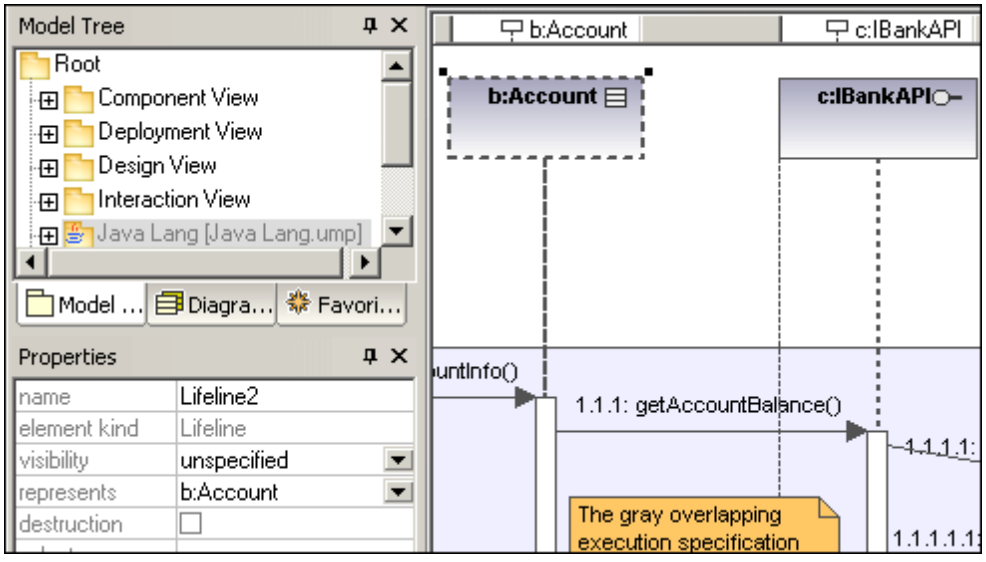
Lifeline

The lifeline element is an individual participant in an interaction. UModel also allows you to insert other elements into the sequence diagram, e.g. classes and actors. Each of these elements appear as a new lifeline once they have been dragged into the diagram pane from the Model Tree tab.

The lifeline label appears in a bar at the top of the sequence diagram. Labels can be repositioned and resized in the bar, with changes taking immediate effect in the diagram tab. You can also redefine the label colors/gradient using the "Header Gradient" combo boxes in the Styles tab.

To create a **multiline** lifeline press CTRL+Enter to create a new line.

Most classifier types can be inserted into the sequence diagram. The "represents" field in the Properties tab displays the element type that is acting as the lifeline. Dragging **typed** properties onto a sequence diagram also creates a lifeline.



Execution Specification (Object activation):
An execution specification (activation) is displayed as a box (rectangle) on the object lifeline. An activation is the execution of a procedure and the time needed for any nested procedures to execute. Activation boxes are automatically created when a message is created between two lifelines.

A recursive, or self message (one that calls a different method in the same class) creates stacked activation boxes.

Displaying/hiding activation boxes:

1. Click the **Styles** tab and scroll to the bottom of the list.
   The "**Show Execution Specifications**" combo box allows you to show/hide the activation boxes in the sequence diagram.

Lifeline attributes:
The **destruction** check box allows you to add a destruction marker, or stop, to the lifeline without having to use a destruction message.

The **selector** field allows you to enter an expression that specifies the particular part represented by the lifeline, if the ConnectableElement is multivalued, i.e. has a multiplicity greater than one.

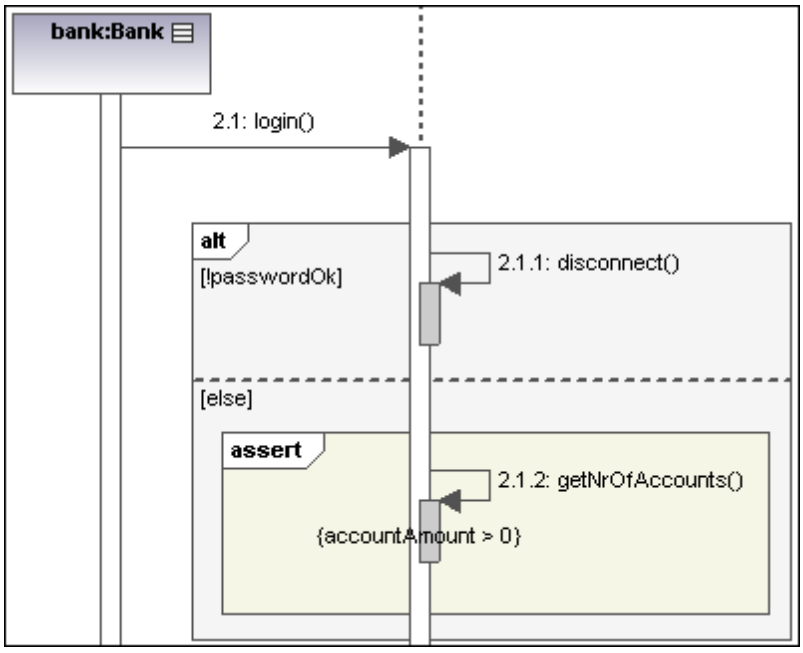
Goto lifeline element

Right clicking a lifeline allows you to select Goto XXX, where XXX is the specific lifeline type that you clicked. The element will then be visible in the Model Tree window.

Combined Fragment

CombinedFragment

Combined fragments are subunits, or sections of an interaction. The **interaction operator** visible in the pentagon at top left, defines the specific kind of combined fragment. The constraint thus defines the specific fragment, e.g. loop fragment, alternative fragment etc. used in the interaction.



The combined fragment icons in the icon bar, allow you to insert a specific combined fragment: seq, alt or loop. Clicking the **interactionOperator** combo box, also allows you to define the specific interaction fragment.

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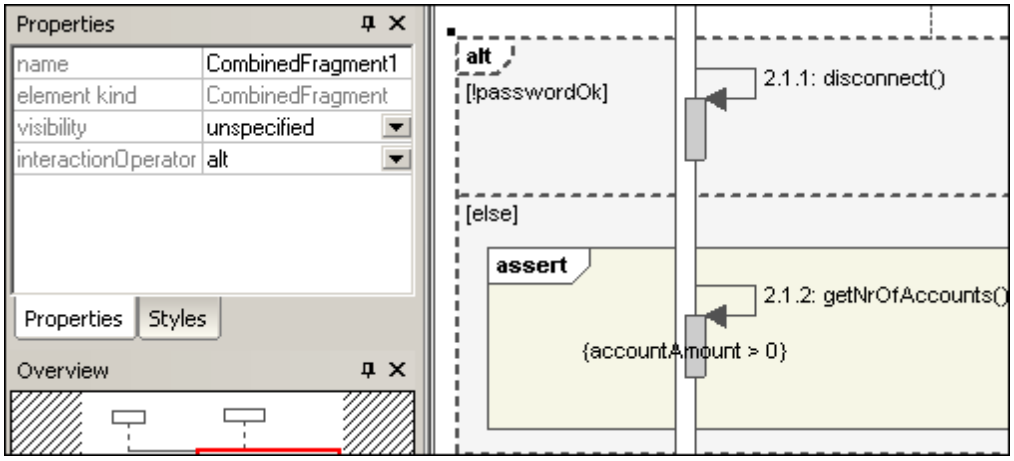


InteractionOperators

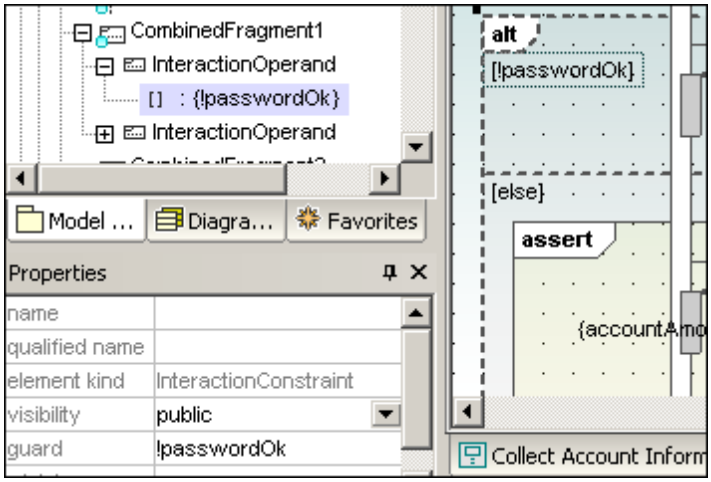
Weak sequencing **seq**

The combined fragment represents weak sequencing between the behaviours of the operands.

Alternatives **alt**

Only one of the defined operands will be chosen, the operand must have a guard expression that evaluates to true.

If one of the operands uses the guard "else", then this operand is executed if all other guards return false. The guard expression can be entered immediately upon insertion, will appear between the two square brackets.



The **InteractionConstraint** is actually the guard expression between the square brackets.

Option **opt**

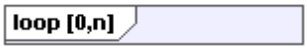
Option represents a choice where either the sole operand is executed, or nothing happens.

Break **break**
The break operator is chosen when the guard is true, the rest of the enclosing fragment is ignored.

Parallel **par**
Indicates that the combined fragment represents a parallel merge of operands.

Strict sequencing **strict**
The combined fragment represents a strict sequencing between the behaviours of the operands.

Loop **loop**
The loop operand will be repeated by the number of times defined in the guard expression.



Having selected this operand, you can directly edit the expression (in the loop pentagon) by double clicking.

Critical Region **critical**
The combined fragment represents a critical region. The sequence(s) may not be interrupted/ interleaved by any other processes.

Negative **neg**
Defines that the fragment is invalid, and all others are considered to be valid.

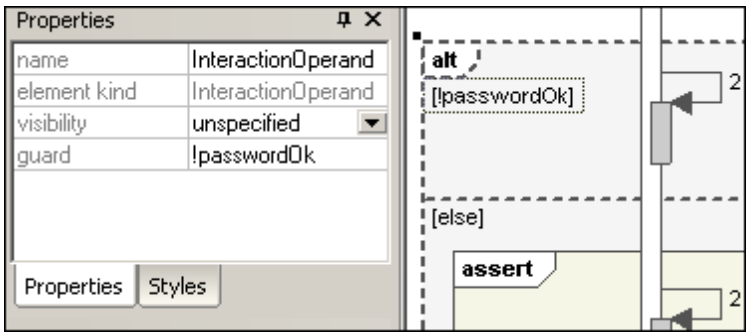
Assert **assert**
Designates the valid combined fragment, and its sequences. Often used in combination with consider, or ignore operands.

Ignore **ignore**
Defines which messages should be ignored in the interaction. Often used in combination with assert, or consider operands.

Consider **consider**
Defines which messages should be considered in the interaction.

Adding InteractionOperands to a combined fragment:

1. Right click the combined fragment and select **New | InteractionOperand**.
   The text cursor is automatically set for you to enter the guard condition.
2. Enter the guard condition for the InteractionOperand e.g. **!passwordOK** and press Enter to confirm.



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Use CTRL+Enter to create a **multi-line** InteractionOperand.

3. Use the same method to add the second interaction operand with the guard condition "else".
   Dashed lines separate the individual operands in the fragment.

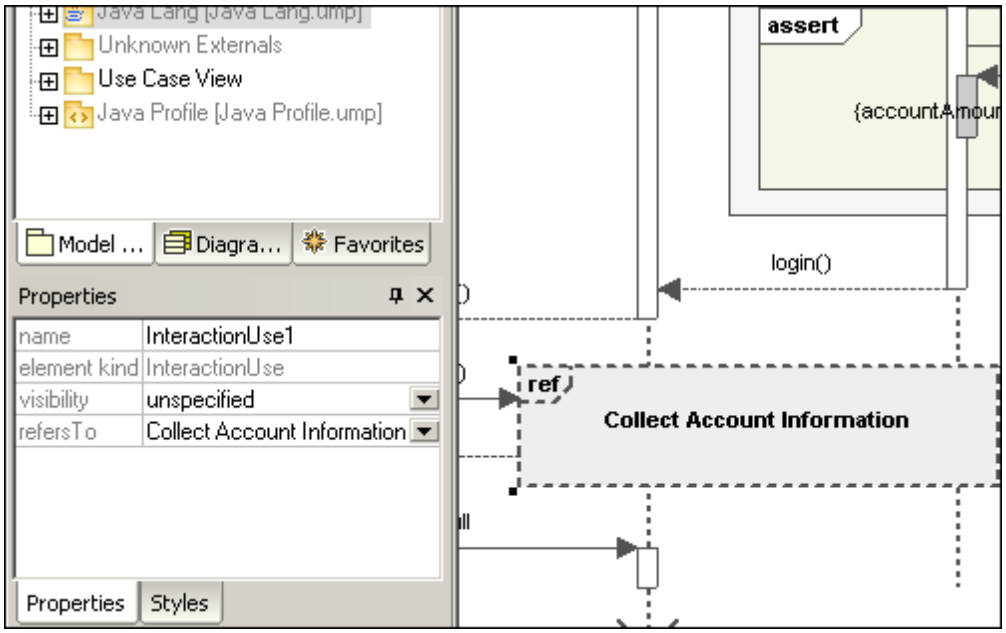
Deleting InteractionOperands:

1. Double click the guard expression in the combined fragment element, of the diagram (not in the Properties tab).
2. Delete the guard expression completely, and press Enter to confirm.
   The guard expression/interaction operand is removed and the combined fragment is automatically resized.

Interaction Use

InteractionUse

The InteractionUse element is a reference to an interaction element. This element allows you to share portions of an interaction between several other interactions.



Clicking the "refersTo" combo box, allows you to select the interaction that you want to refer to. The name of the interaction use you select, appears in the element.

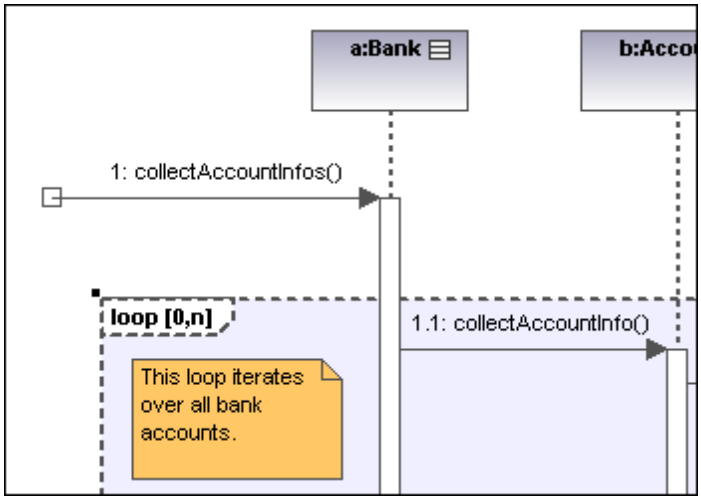
Please note:
You can also drag an existing Interaction Use element from the Model Tree into the diagram tab.

Gate

Gate

A gate is a connection point which allows messages to be transmitted into, and out of, interaction fragments. Gates are connected using messages.

1. Insert the gate element into the diagram.
2. Create a new message and drag from the gate to a lifeline, or drag from a lifeline and drop onto a gate.
   This connects the two elements. The square representing the gate is now smaller.



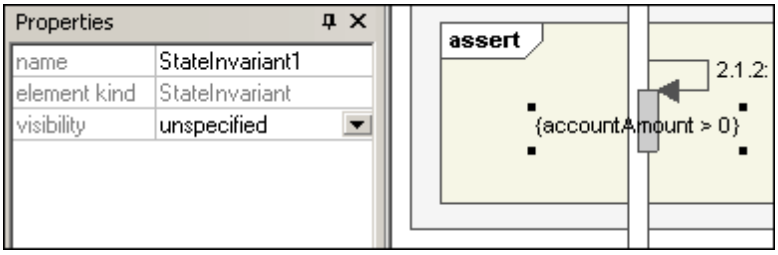
State Invariant

StateInvariant

A StateInvariant is a condition, or constraint applied to a lifeline. The condition must be fulfilled for the lifeline to exist.

To define a StateInvariant:

1. Click the State invariant icon, then click a lifeline, or an object activation to insert it.
2. Enter the condition/constraint you want to apply, e.g. accountAmount > 0, and press Enter to confirm.



Messages

Messages are sent between sender and receiver lifelines, and are shown as labeled arrows. Messages can have a sequence number and various other optional attributes: argument list etc. Messages are displayed from top to bottom, i.e. the vertical axis is the time component of the sequence diagram.

- A **call** is a synchronous, or asynchronous communication which invokes an operation that allows control to return to the sender object. A call arrow points to the **top** of the activation that the call initiates.
- Recursion, or calls to another operation of the same object, are shown by the stacking of activation boxes (Execution Specifications).

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To insert a message:

1. Click the specific message icon in the Sequence Diagram toolbar.
2. Click the lifeline, or activation box of the sender object.
3. Drag and drop the message line onto the receiver objects lifeline or activation box. Object lifelines are highlighted when the message can be dropped.

- The direction in which you drag the arrow defines the message direction. Reply messages can point in either direction.
- Activation box(es) are automatically created, or adjusted in size, on the sender/receiver objects. You can also manually size them by dragging the sizing handles.
- Depending on the message numbering settings you have enabled, the numbering sequence is updated.
- Having clicked a message icon and holding down CTRL, allows you to insert multiple messages by repeatedly clicking and dragging in the diagram tab.

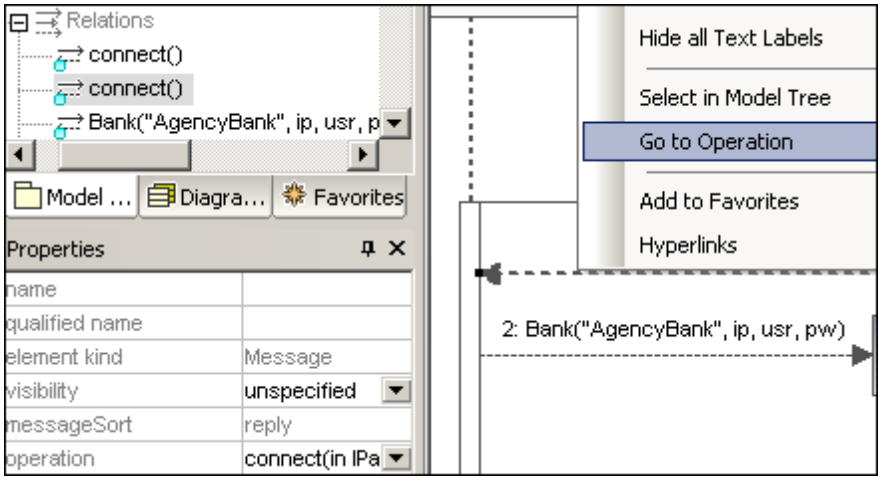
To delete a message:

1. Click the specific message to select it.
2. Press the Del. key to delete it from the model, or right click it and select "Delete from diagram".
   The message numbering and activation boxes of the remaining objects are updated.

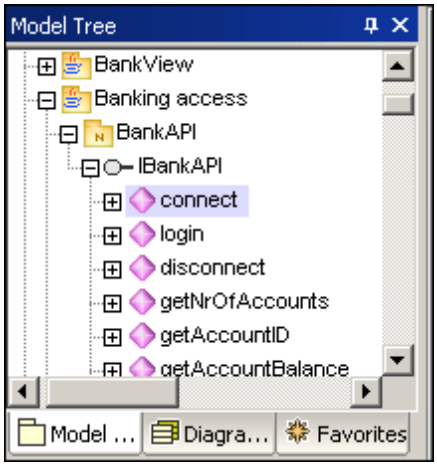
"Go to operation" for call messages:

The operations referenced by call messages can be found in sequence and communication diagrams.

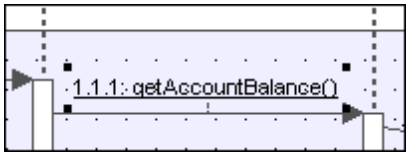
1. Right click a call message and select "Go to Operation".



The display changes and the connect operation is displayed in the Model Tree tab.



Please note:
Static operation names are show as underlined in sequence diagrams.



To position dependent messages:

1. Click the respective message and drag vertically to reposition it.
   The default action when repositioning messages, is it to move all dependent messages related to the active one.

   Using CTRL+click, allows you to select multiple messages.

To position messages individually:

1. Click the "**Toggle dependent message movement**" icon to deselect it.
2. Click the message you want to move and drag to move it.
   Only the selected message moves during dragging. You can position the message anywhere in the vertical axis between the object lifelines.

To automatically create reply messages:

1. Click the "**Toggle automatic creation of replies for messages**" icon .
2. Create a new message betwween two lifelines.
   A reply message is automatically inserted for you.

Message numbering:
UModel supports different methods of message numbering: nested, simple and none.

- **None** removes all message numbering.
- **Simple** assigns a numerical sequence to all messages from top to bottom i.e. in the order that they occur on the time axis.
- **Nested** uses the decimal notation, which makes it easy to see the hierarchical structure of the messages in the diagram. The sequence is a dot-separated list of

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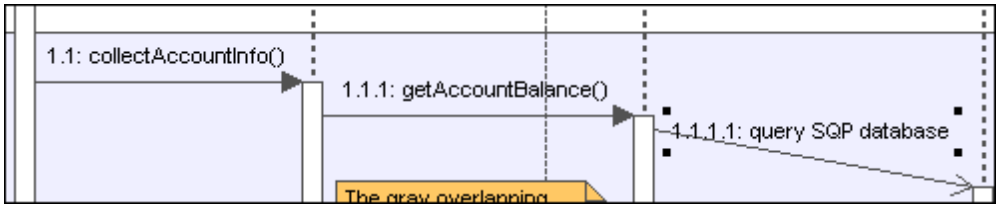
sequence numbers followed by a colon and the message name.



To select the message numbering scheme:

There are two methods of selecting the numbering scheme:

- Click the respective icon in the icon bar.
- Use the Styles tab to select the scheme.

To select the numbering scheme using the Styles tab:

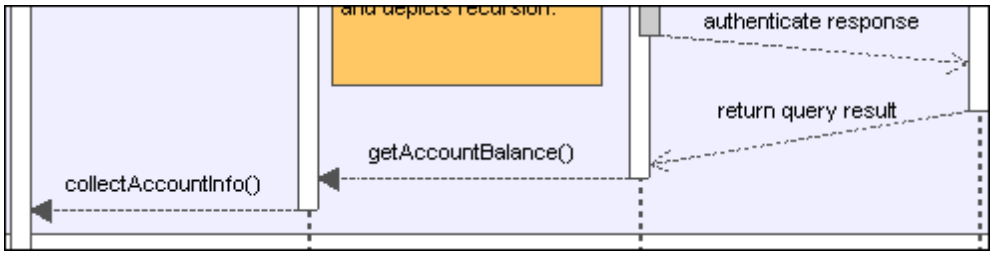
1. Click the Styles tab and scroll down to the **Message Numbering** field.
2. Click the combo box and select the numbering option you want to use.
   The numbering option you select is immediately displayed in the sequence diagram.

Please note:

The numbering scheme might not always correctly number all messages, if ambiguous traces exist. If this happens, adding return messages will probably clear up any inconsistencies.

Message replies:

Message reply icons are available to create reply messages, and are displayed as dashed arrows.

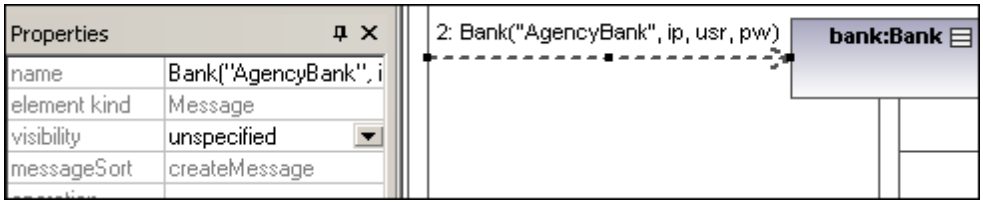


Reply messages are also generally implied by the bottom of the activation box when activation boxes are present. If activation boxes have been disabled (**Styles tab | Show Execution Specifics=false**), then reply arrows should be used for clarity.

Activating the "toggle reply messages" icon, automatically creates syntactically correct reply messages when creating a call message between lifelines/activations boxes.

Creating objects with messages:

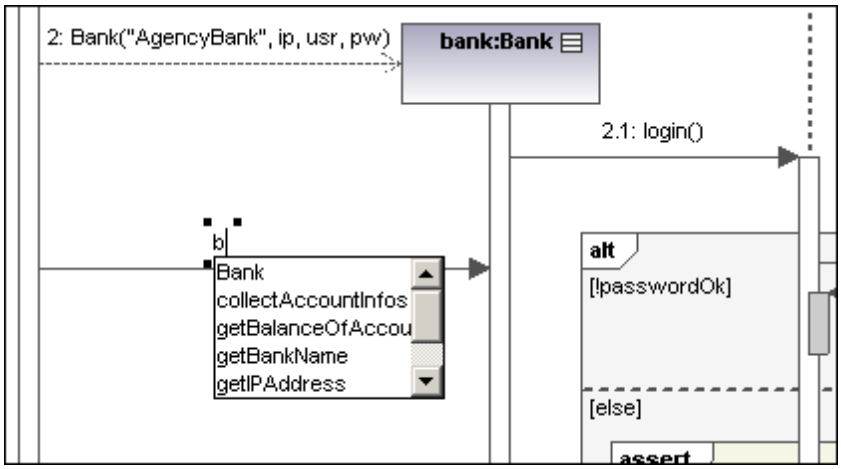
1. Messages can create new objects. This is achieved using the Message Creation icon .
2. Drag the message arrow to the lifeline of an existing object to create that object.
   This type of message ends in the middle of an object rectangle, and often repositions the object box vertically.



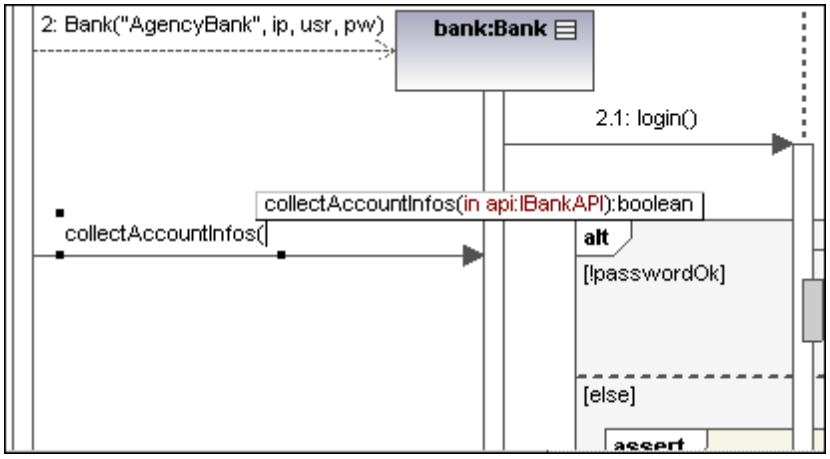
Sending messages to specific class methods/operations in sequence diagrams

Having inserted a class from the Model Tree into a sequence diagram, you can then create a message from a lifeline to a specific method of the receiver class (lifeline) using UModel's syntax help and autocompletion functions.

1. Create a message between two lifelines, the receiving object being a class lifeline (Bank) As soon as you drop the message arrow, the message name is automatically highlighted.
2. Enter a character using the keyboard e.g. "b".
   A pop-up window containing a list of the existing class methods is opened.



3. Select an operation from the list, and press Enter to confirm e.g. collectAccountInfos.
4. Press the spacebar and press Enter to select the parenthesis character that is automatically supplied.
   A syntax helper popup now appears, allowing you to enter the parameter correctly.



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Creating operations in referenced classes

Activating the "Toggle automatic creation of operations in target by typing operation names" icon, automatically creates the corresponding operation in the referenced class, when creating a message and entering a name e.g. myOperation().

Note: operations can only be created automatically when the lifeline references a class, interface...

Message icons:

Message (Call)

Message (Reply)

Message (Creation)

Message (Destruction)

Asynchronous Message (Call)

Asynchronous Message (Reply)

Asynchronous Message (Destruction)

Toggle dependent message movement

Toggle automatic creation of replies for messages

Toggle automatic creation of operations in target by typing operation names

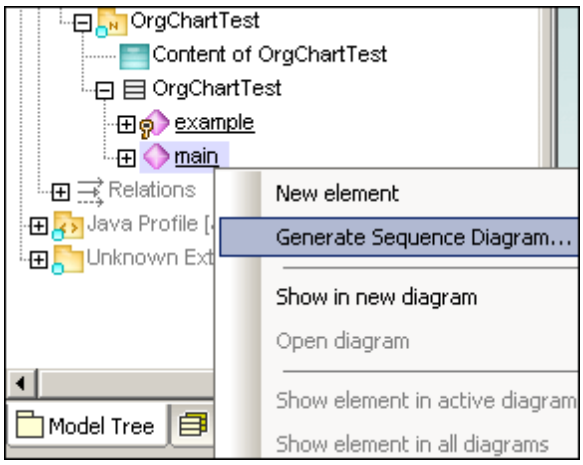
Generating Sequence Diagrams from source code

UModel is able to create sequence diagram models directly from code.

The example below shows how to automatically create a sequence diagram by using an existing

method. You can, of course, use the same approach on your own code. The method is available in the OrgChart package which was imported using the **Project | Import Source Directory** command in the tutorial. Please see Round-trip engineering (code - model - code) in the tutorial for more information on importing code.

1. Having imported the code, right click the **main** method of the **OrgChartTest** class, in the Model Tree and select **Generate Sequence Diagram...**



This opens the Sequence Diagram Generation dialog box in which you define the generation settings.

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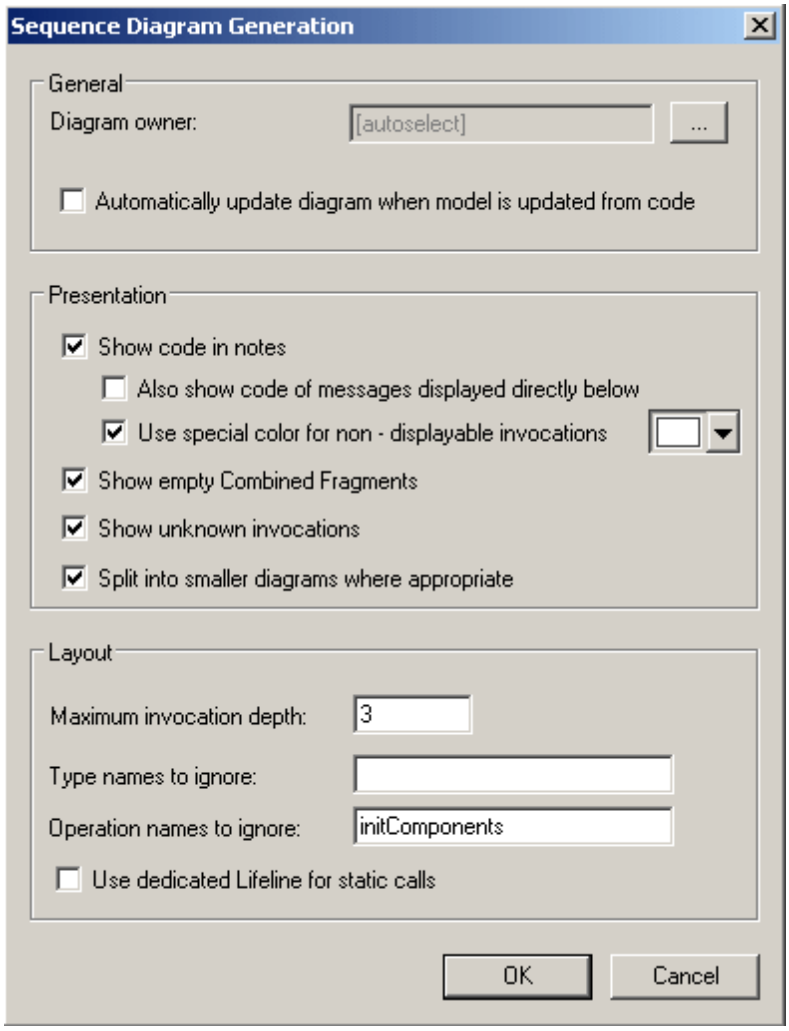
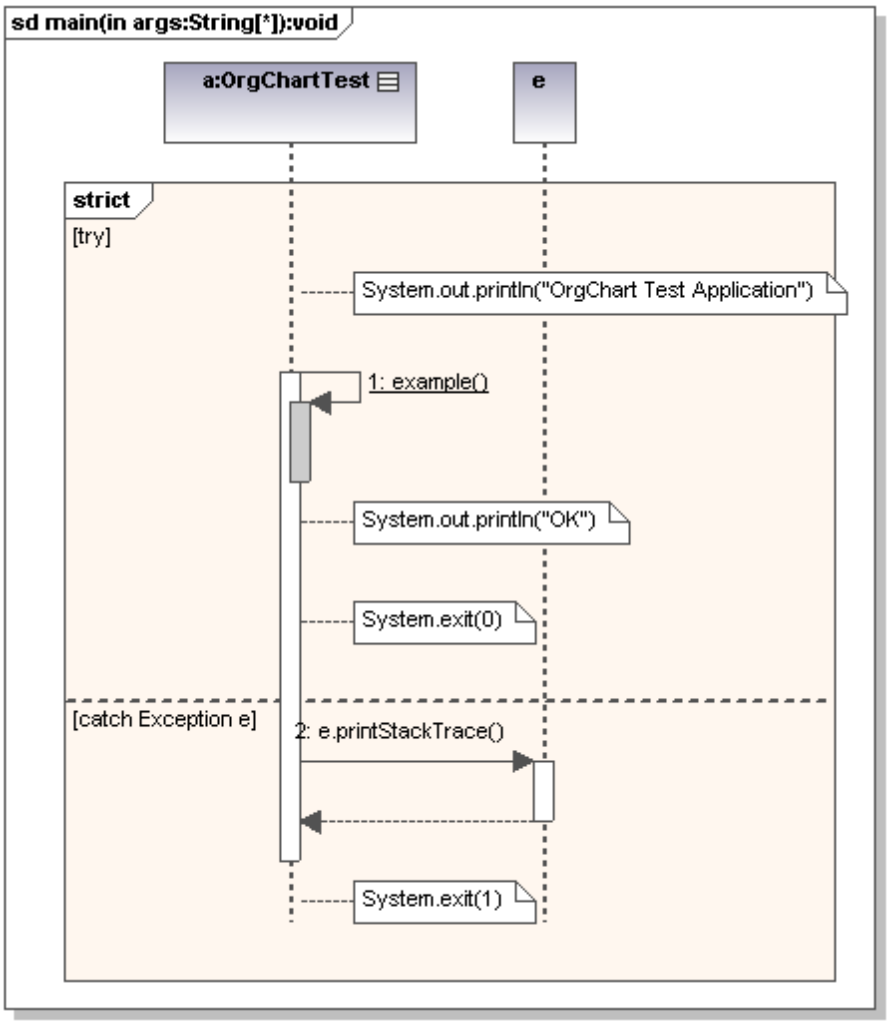


2. Select the presentation and layout options, then click OK to generate the diagram. The settings shown above produce the sequence diagram below.



Notes:

- You can assign a special color to the non-displayable invocations.
- The maximum **invocation depth** defines the **recursion** depth to be used in the diagram.
- The "**Type names to ignore**" option, allows you to define a comma delimited list of types that should not appear in the sequence diagram when it is generated.
- The "**Operation names to ignore**" option allows you define a comma delimited list of operations that should not appear in the generated sequence diagram (initComponents are automatically added as a default).

  Adding the operation names to the list e.g. "InitComponents" causes the complete operation to be ignored. Prepending a + character to the operation in the list e.g. **+InitComponent**, causes the the operation calls to be shown in the diagram, but without their content.
- The "**Split into smaller diagrams where appropriate**" option automatically splits sequence diagrams into smaller sub-diagrams, and automatically generates hyperlinks between them for easy navigation.

Sequence diagrams are automatically updated when you update the complete UModel project. Sequence diagrams are not updated if you update classes, or individual files, externally. You can

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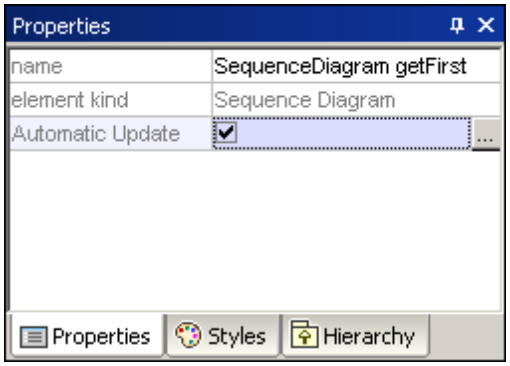
however change this setting by clicking on the diagram background and clicking the "Automatic Update" checkbox.



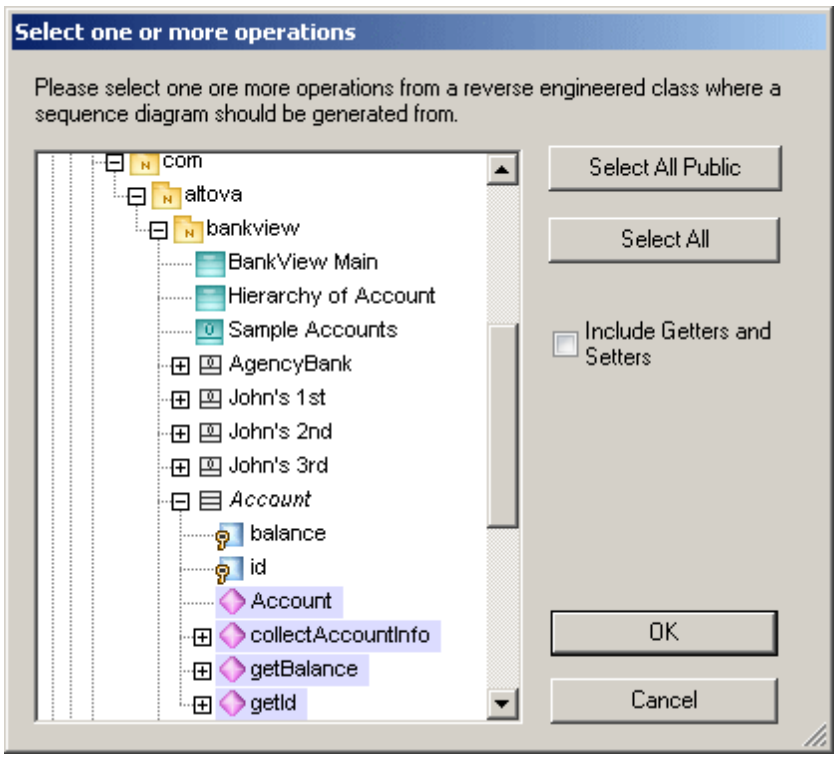
Clicking the ... icon of the Automatic Update field, opens the Sequence Diagram Generation dialog box allowing you to change the sequence diagram generation settings.

Generate Sequence diagrams from properties

UModel is able to create multiple sequence diagram models from multiple operations, as well as sequence diagrams from Getter / Setter properties.

Creating multiple sequence diagrams from multiple operations:

1. Select the menu option **Project | Generate Sequence diagrams**.
   This opens the **Select one or more operations** dialog box.



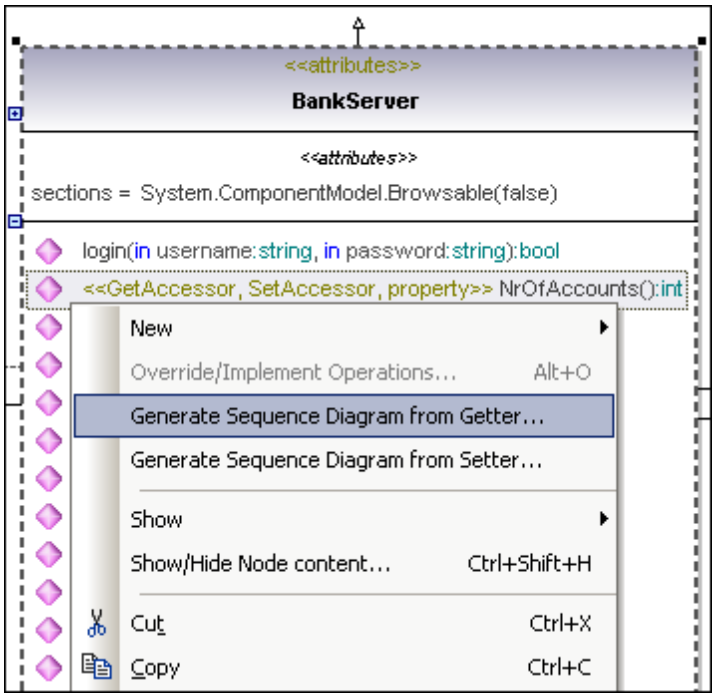
2. Select the operations that you want to generate a sequence diagram for and click OK. (Use the Select All Public and Select All buttons where necessary.)
   Clicking OK opens the Sequence Diagram Generation dialog box, in which you can further specify the sequence diagram generation options.

3. Click OK to generate the sequence diagrams.
   A sequence diagram is generated for each selected operation.

   Note: you can now choose to include/exclude Getters and Setters, when generating the sequence diagram.

Creating a sequence diagram from getter/setter properties (C#, VB .NET)

1. Right click an Operation with a GetAccessor/SetAccessor stereotype.



2. Select the option from the context menu that you want to create a sequence diagram from (Getter/Setter).
   This opens the Sequence Diagram Generation dialog box in which you can further specify the sequence diagram presentation settings.

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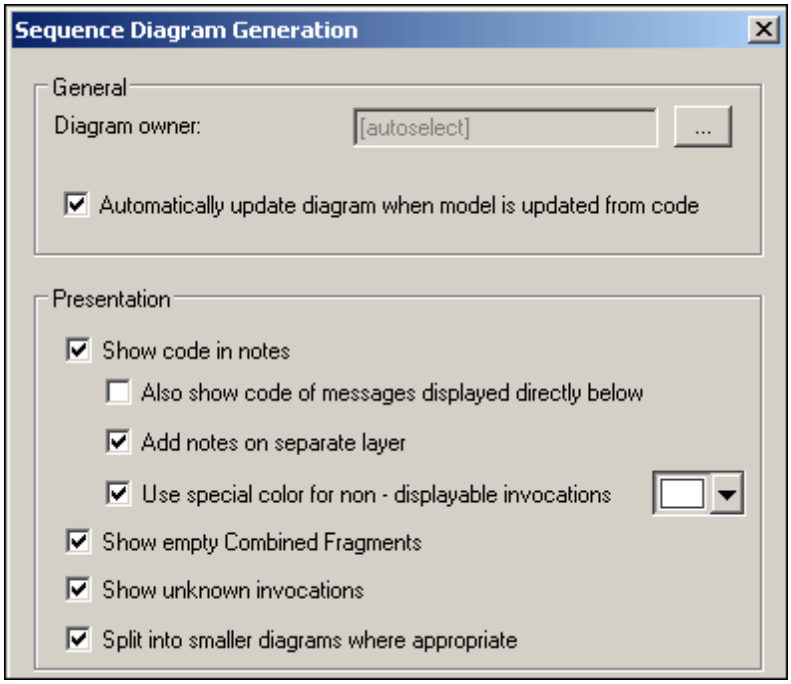

Sequence Diagram Generation
General
Diagram owner:
[autoselect]
...
Automatically update diagram when model is updated from code
Presentation
Show code in notes
Also show code of messages displayed directly below
Add notes on separate layer
Use special color for non - displayable invocations
Show empty Combined Fragments
Show unknown invocations
Split into smaller diagrams where appropriate

3. Click OK to generate the Sequence Diagram.

Generate code from sequence diagram

UModel can create code from a sequence diagram which is linked to at least one operation.

Code generation from sequence diagrams is available for:

- VB.NET, C# and Java
- UModel standalone, Eclipse, and Visual Studio editions
- All three UModel editions

Creating code from Sequence diagrams is possible by either:

- Starting from a reverse engineered operation, see Generating Sequence Diagrams from source code,
- By creating a **new** sequence diagram from scratch, which is linked to an operation, by right-clicking the operation (in the Model Tree) and selecting Create sequence diagram for code.

Notes:
When using a reverse engineered sequence diagram as basis, ensure that the option "Show code in notes" is selected when reverse engineering the code, so you do not lose any code when you start the forward-engineering process again.

This is due to the fact that UML is not able to display all the language features of VB.NET, Java and C# on the sequence diagram, and those code sections are therefore shown as code notes.

To add plain text as code when creating a sequence diagram:

1. Attach a note to a sequence diagram lifeline.
2. Type in the code which should be written into the final source code.
   Click the "Is Code" check box (in the Properties pane) for that note, to make it accessible.

Please see Adding code to sequence diagrams for an example.

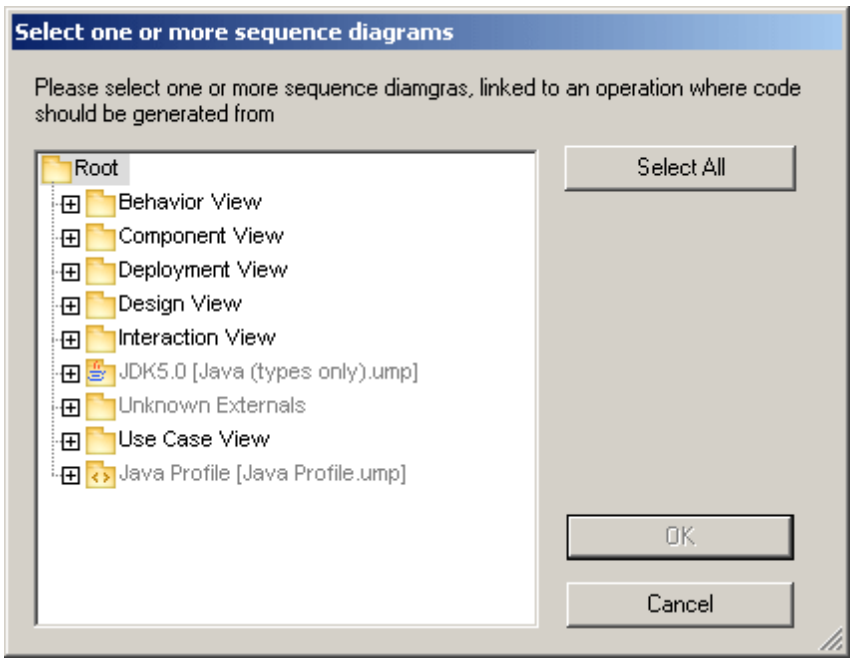
If a Sequence Diagram is to be used for code engineering automatically every time code engineering is started:

- Activate the "Use for forward engineering" check box in the property pane when the sequence diagram is selected.

Old code will always be lost when forward engineering code from a sequence diagram, because it will be overwritten with the new code.

Project menu:

1. Select the menu option **Project | Generate Code from Sequence Diagrams**.
   You are now prompted to select the specific Sequence Diagram(s).



   Clicking the "Select All" button selects all the Sequence Diagrams in the UModel project.
2. Click OK to generate the code.
   The Messages window shows the status of the code generation process.

Model Tree:

- Right click a Sequence Diagram and select Generate Code from Sequence diagram.

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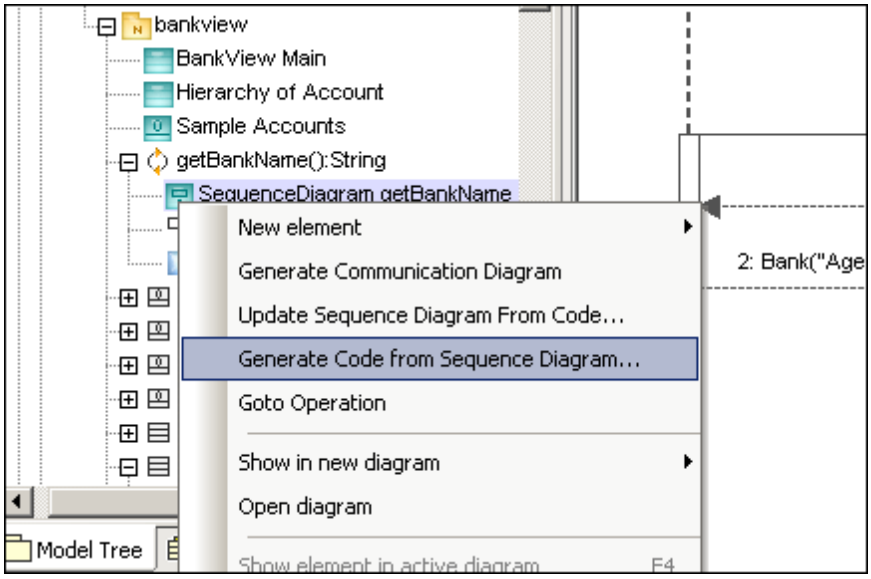
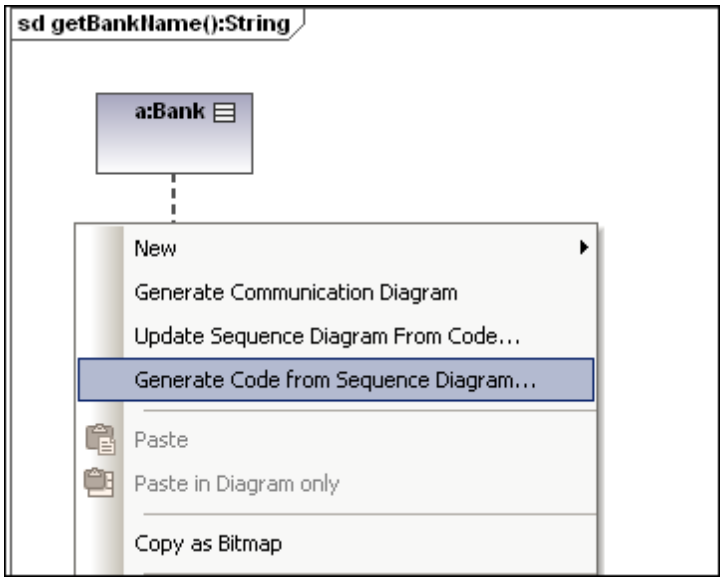


Sequence Diagram containing code of an operation:

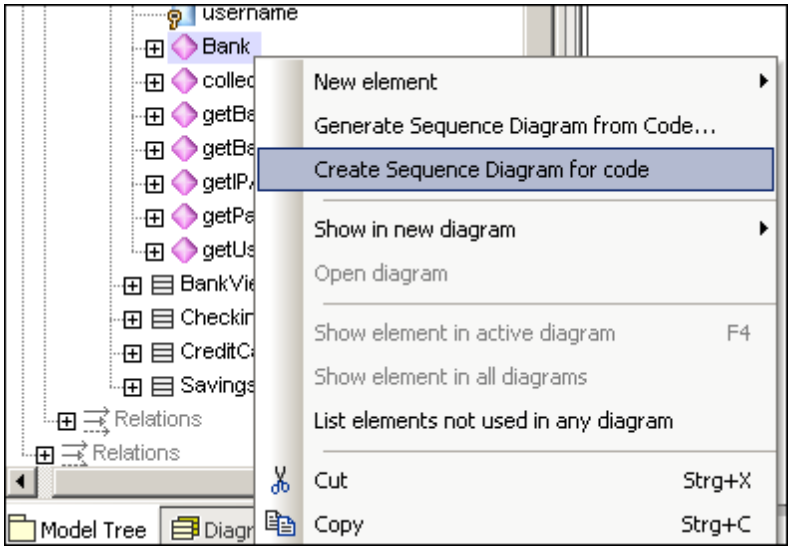
1. Click into the empty space of the Sequence Diagram, that contains code of an operation.
2. Select Generate Code from Sequence diagram.



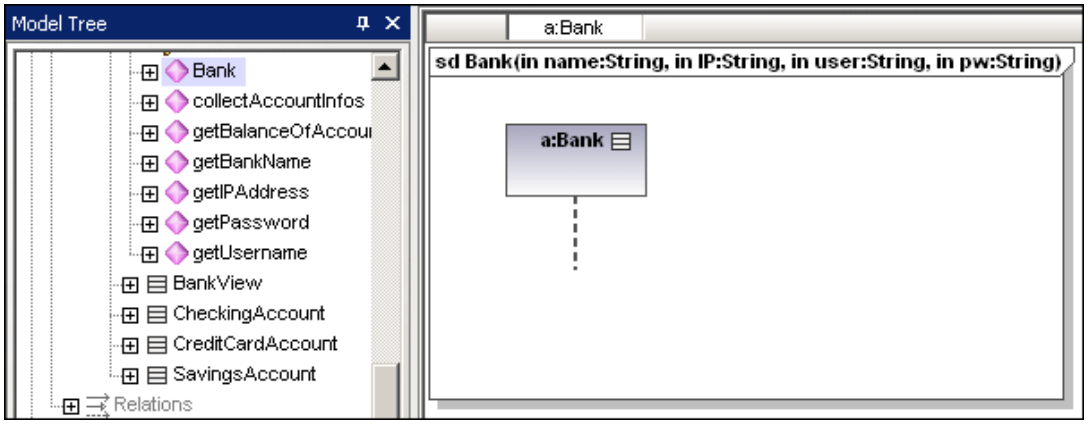
This command starts the forward-engineering process at this point.

To create a Sequence diagram for code (engineering):

1. In the Model Tree, right click an operation and select Create Sequence diagram for code.



You will then be prompted if you want to use the new diagram for forward engineering.



The result is a new Sequence Diagram containing the lifeline of that class.

Adding code to sequence diagrams

Program code can be generated from new, and reverse-engineered sequence diagrams, but only for a sequence diagram linked to the "main operation".

When reverse-engineering code, standard sequence diagram elements, e.g. CombinedFragments, are "mapped/assigned" to coding elements (e.g. "if" statements, loops, etc.).

For those programming statements that have no corresponding sequence diagram elements, e.g. "i = i+1", UModel makes use of "code" notes to add code to diagrams. These notes must then be linked to the lifeline.

Note that UModel does not check, or parse, these code fragments. It is up to you to make sure that the code fragments are correct and will compile.

To add code to a sequence diagram:

1. Click the Note icon then click the model element where you want to insert it, e.g.

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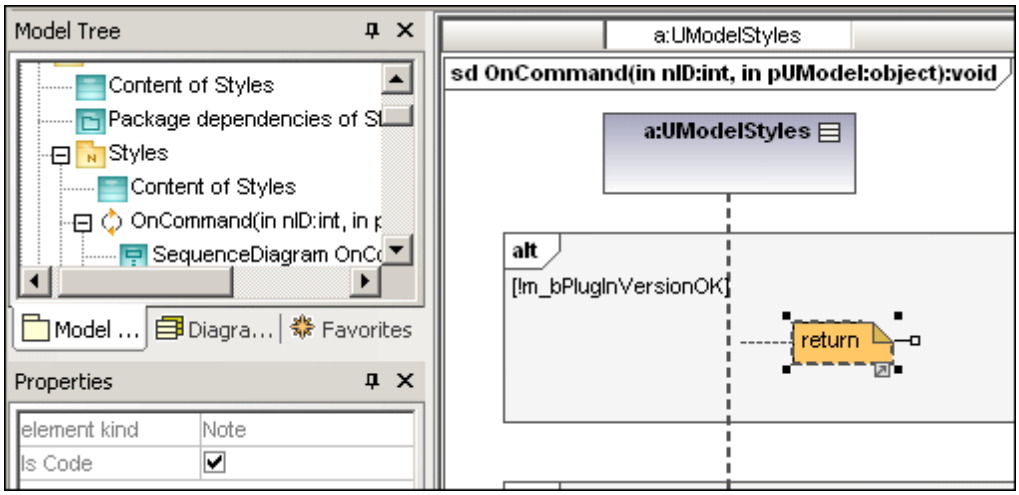
CombinedFragment.

2 Enter the code fragment, e.g. return.
3. Click the Node Link handle of the inserted note and drop the cursor on the lifeline.
4. Activate the "Is Code" check box in the Properties tab to include this code fragment when generating code.



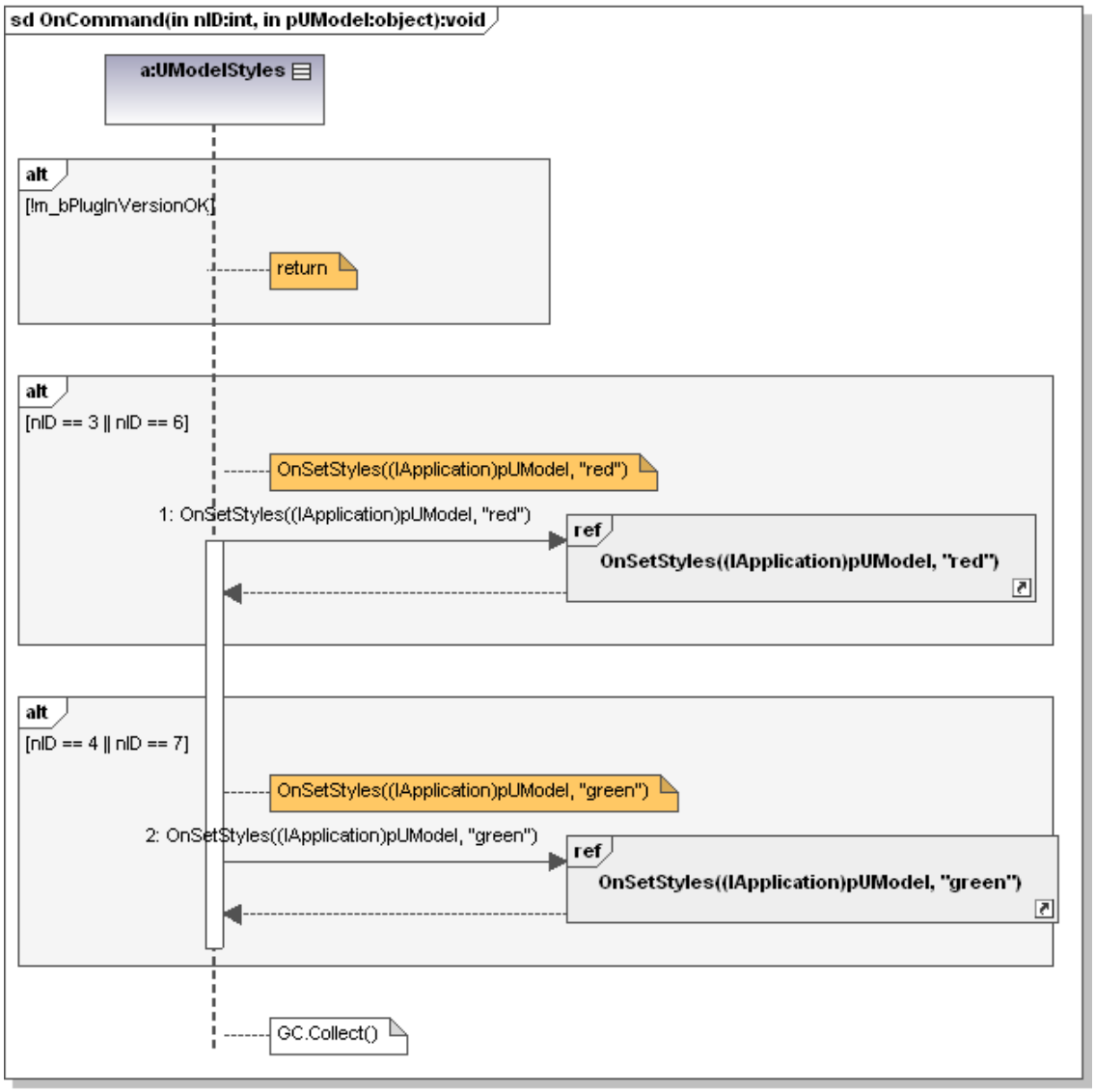
When selecting a note on a sequence diagram, which **can** be used for code generation, the property "is code" is available in the Properties window. Clicking the check box, allows you to switch between "ordinary" notes and code generation notes.

Ordinary notes: return

Code generation notes: return - shown with a darker dog-ear

Code updates occur automatically on every forward engineering process if the "Use for forward engineering" check box is active. If changes were made to the sequence diagram, the code of the operation is always overwritten.

The sequence diagram shown below was generated by right clicking the **OnCommand** operation and selecting "Generate sequence diagram from code". The C# code of this example is available in the c:\Documents and Settings\<user>\My Documents\Altova\UModel2012\UModelExamples \IDEPlugIn\Styles\ folder. Use the option **Project | Import Source Project**, to import the project.



The code shown below is generated from the sequence diagram.

```
Public void OnCommand(int nID, object pUModel)
{
   //Generated by UModel. This code will be overwritten when you re-run code
generation.

   if (!m_bPlugINVersionOK)
   {
   return;
   }

   if (nID == 3 || nID == 6)
   {
   OnSetStyles((IApplication)pUModel, "red");
   }

   if (nID == 4 || nID == 7)
```

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```
        {
        OnSetStyles((IApplication)pUModel, "green");
        }
        GC.Collect();

    }
```

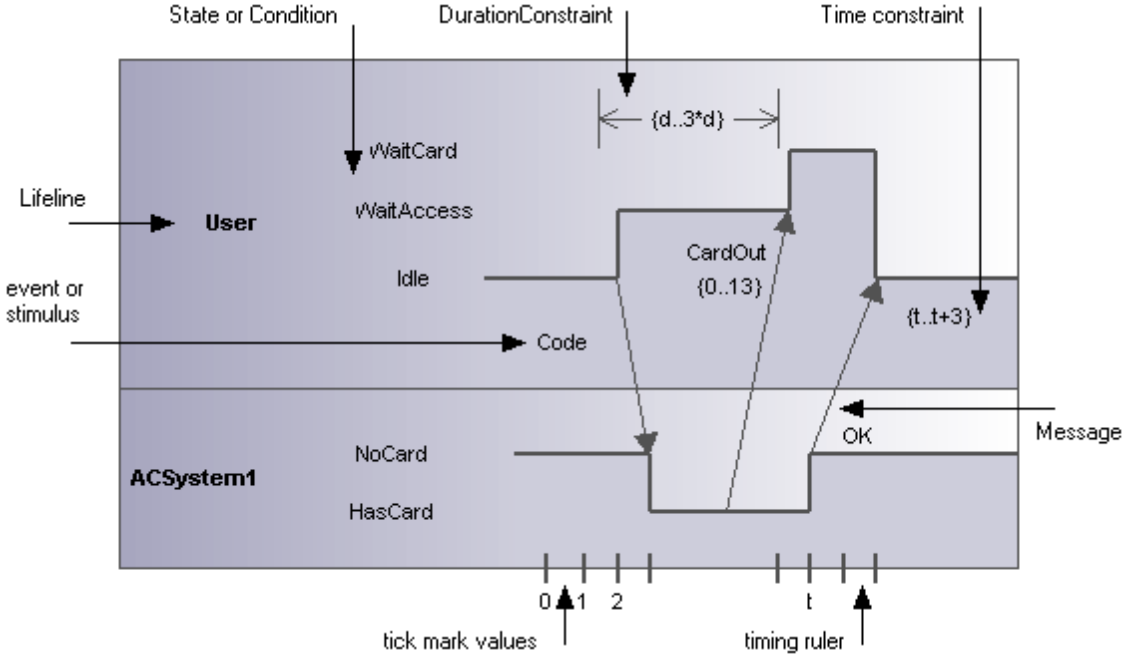
9.1.8 Timing Diagram

Altova web site: UML Timing diagrams

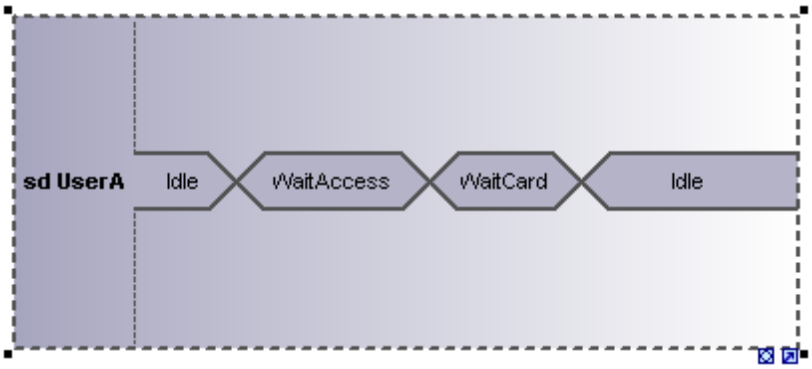
Timing diagrams depict the changes in state, or condition, of one or more interacting objects over a given period of time. States, or conditions, are displayed as timelines responding to message events, where a lifeline represents a Classifier Instance or Classifier Role.

A Timing diagram is a special form of a sequence diagram. The difference is that the axes are reversed i.e. time increases from left to right, and lifelines are shown in separate vertically stacked compartments.

Timing diagrams are generally used when designing embedded software or real-time systems.



There are two different types of timing diagram: one containing the State/Condition timeline as shown above, and the other, the General value lifeline, shown below.



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Inserting Timing Diagram elements

Using the toolbar icons:

1. Click the specific timing icon in the Timing Diagram toolbar.

2. Click in the Timing Diagram to insert the element.
   Note that holding down CTRL and clicking in the diagram tab, allows you to insert multiple elements of the type you selected.

Dragging existing elements into the timing machine diagram:
Elements occurring in other diagrams, e.g. classes, can be inserted into an Timing Diagram.

1. Locate the element you want to insert in the Model Tree tab (you can use the search function text box, or press CTRL+F, to search for any element).
2. Drag the element(s) into the state diagram.

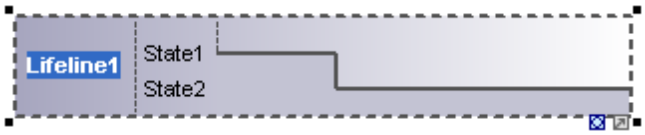
Lifeline

or **Lifeline**

The lifeline element is an individual participant in an interaction, and is available in two different representations: State/Condition timeline or General Value lifeline. To create a **multiline** lifeline press CTRL+Enter to create a new line.

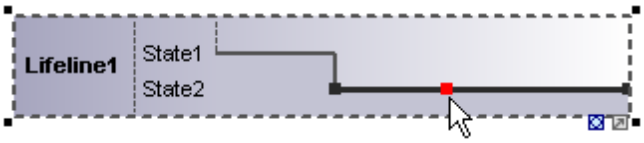
To insert a State Condition (StateInvariant) lifeline and define state changes:

1. Click the Lifeline (State/Condition) icon in the title bar, then click in the Timing Diagram to insert it.

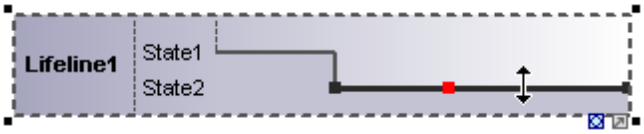


2. Enter the lifeline name to change it from the default name, Lifeline1, if necessary.
3. Place the mouse cursor over a section of one of the timelines and click left. This selects the line.
4. Move the mouse pointer to the position you want a state change to occur, and click again.

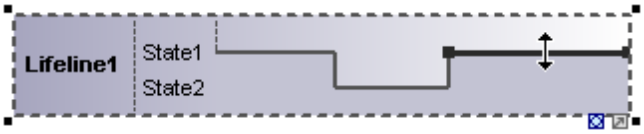
   Note that you will actually see the double headed arrow when you do this.



   A red box appears at the click position and divides the line at this point.
5. Move the cursor to the right hand side of the line and drag the line upwards.



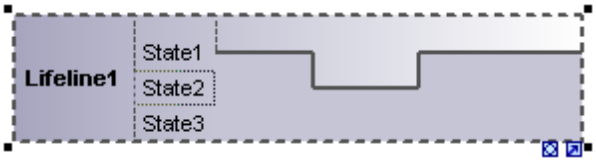
Note that lines can only be moved between existing states of the current lifeline.



Any number of state changes can be defined per lifeline. Once the red box appears on a line, clicking anywhere else in the diagram deletes it.

To add a new state to the lifeline:

1. Right click the lifeline and select **New | State/Condition (StateInvariant)**.
   A new State e.g. State3 is added to the lifeline.



To move a state within a lifeline:

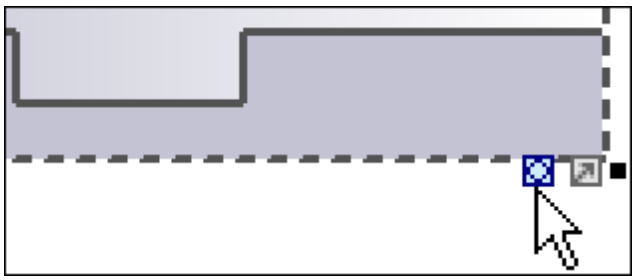
1. Click the state label that you want to move.
2. Drag it to a different position in the lifeline.

To delete a state from a lifeline:

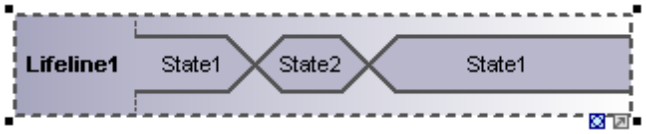
1. Click the state and press the Del. key, or alternatively, right click and select Delete.

To switch between timing diagram types:

1. Click the "toggle notation" icon at the bottom right of the lifeline.



This changes the display to the General Value lifeline, the cross-over point represents a state/value change.



Please note that clicking the Lifeline (General Value) icon , inserts the lifeline as shown above. You can switch between the two representations at any time.

To add a new state to the General value lifeline:

1. Right click the lifeline and select **New | State/Condition (StateInvariant)**.
2. Edit the new name e.g. State3, and press Enter to confirm.

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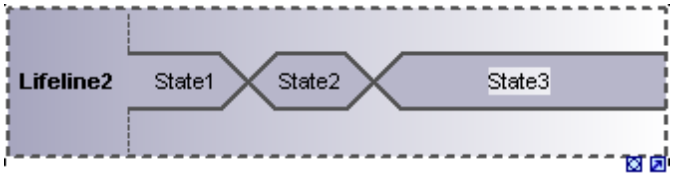
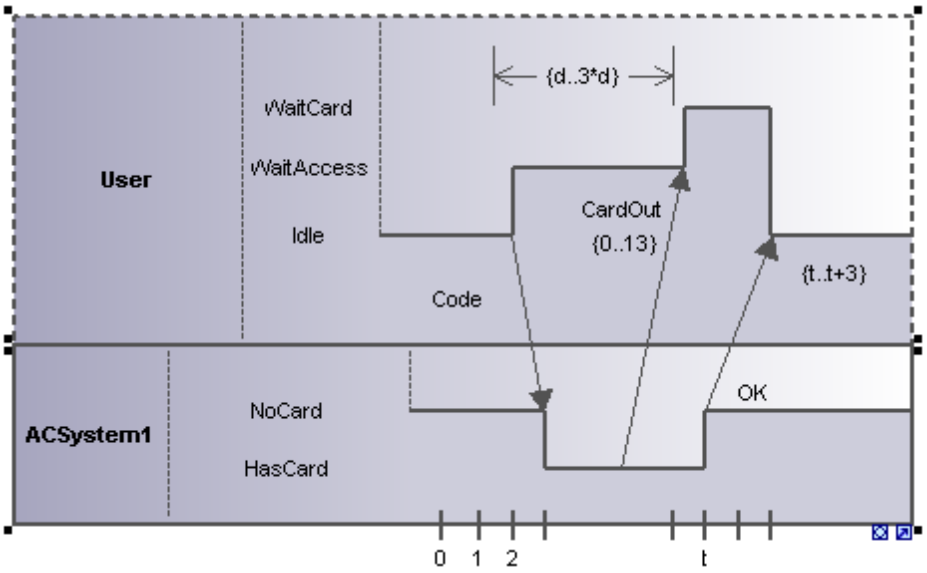


A new State is added to the lifeline.

Grouping lifelines

Placing, or stacking lifelines, automatically positions them correctly and preserves any tick marks that might have been added. Messages can also be created between separate lifelines by dragging the respective message object.



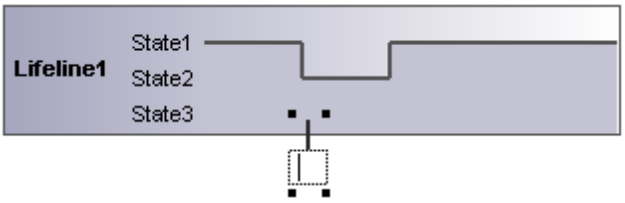
Tick Mark

TickMark

The tick mark is used to insert the tick marks of a timing ruler scale onto a lifeline.

To insert a TickMark:

1. Click the tick mark icon and click on the lifeline to insert it.

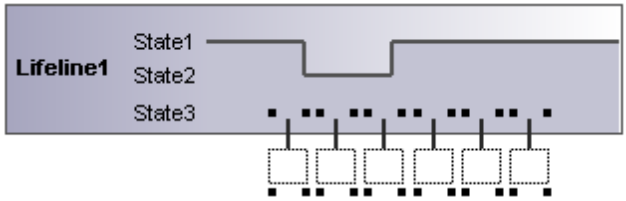


2. Insert multiple tick marks by holding down the CTRL key and repeatedly clicking at different positions on the lifeline border.
3. Enter the tick mark label in the field provided for it.
   Drag tick marks to reposition them on the lifeline.

To evenly space tick marks on a lifeline:

1. Use the marque, by dragging in the main window, to mark the individual tick marks.

2. Click the **Space Across** icon in the icon bar.



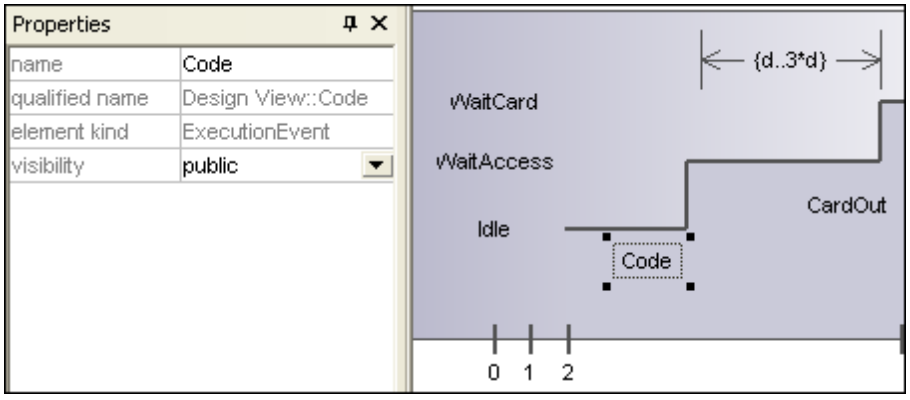
Event/Stimulus

Event / Stimulus

The Event/Stimulus ExecutionEvent is used to show the change in state of an object caused by the respective event or stimulus. The received events are annotated to show the event causing the change in condition or state.

To insert an Event/Stimulus:

1. Click the Event/Stimulus icon, then click the specific position in the timeline where the state change takes place.



2. Enter a name for the event, in this example the event is "Code".
   Note that the event properties are visible in the Properties tab.

DurationConstraint

DurationConstraint

A Duration defines a ValueSpecification that denotes a duration in time between a start and endpoint. A duration is often an expression representing the number of clock ticks, which may elapse during this duration.

To insert an DurationConstraint:

1. Click the DurationConstraint icon, then click the specific position on the lifeline where the constraint is to be displayed.

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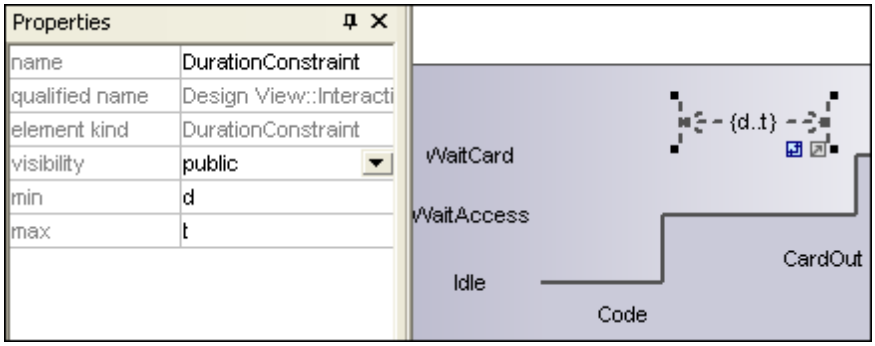
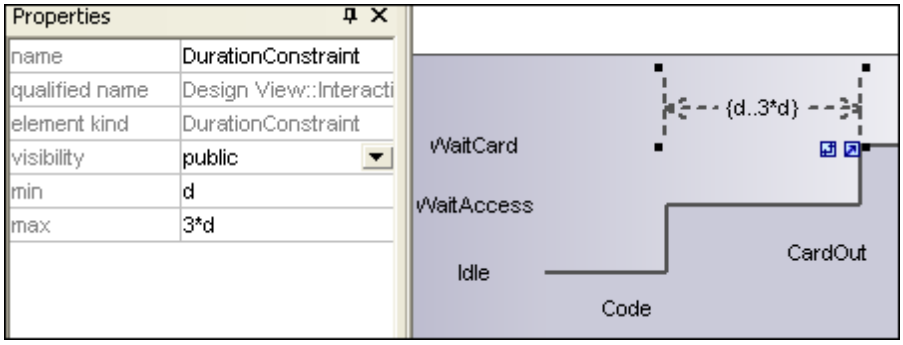


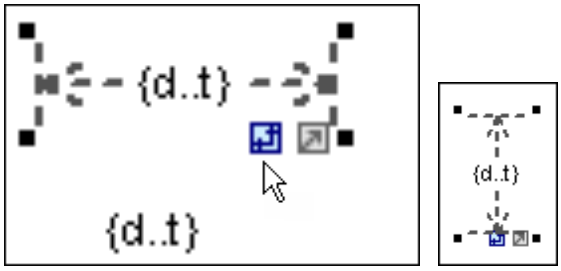
The default minimum and maximum values, "d..t", are automatically supplied. These values can be edited by double clicking the time constraint, or by editing the values in the Properties window.

2. Use the "handles" to resize the object if necessary.



Changing the orientation of the DurationConstraint:

1. Click the "Flip" icon to orient the constraint vertically.



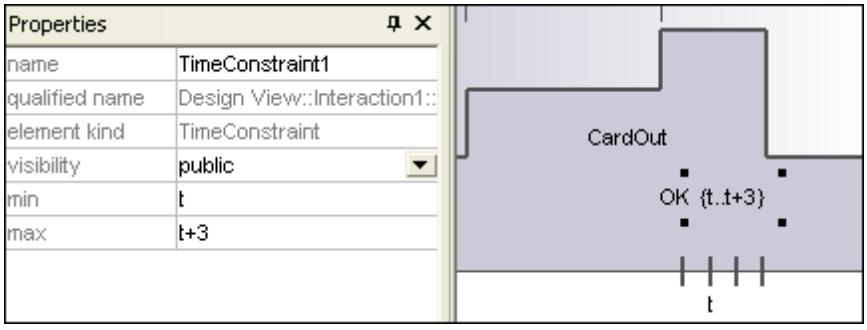
TimeConstraint

TimeConstraint

A TimeConstraint is generally shown as graphical association between a TimeInterval and the construct that it constrains. Typically this graphical association between an EventOccurrence and a TimeInterval.

To insert a TimeConstraint:

1. Click the TimeConstraint icon, then click the specific position on the lifeline where the constraint is to be displayed.



The default minimum and maximum values are automatically supplied, "d..t" respectively. These values can be edited by double clicking the time constraint, or by editing the values in the Properties window.

Message

Message (Call) **Message (Reply)** **Async message (Call)**

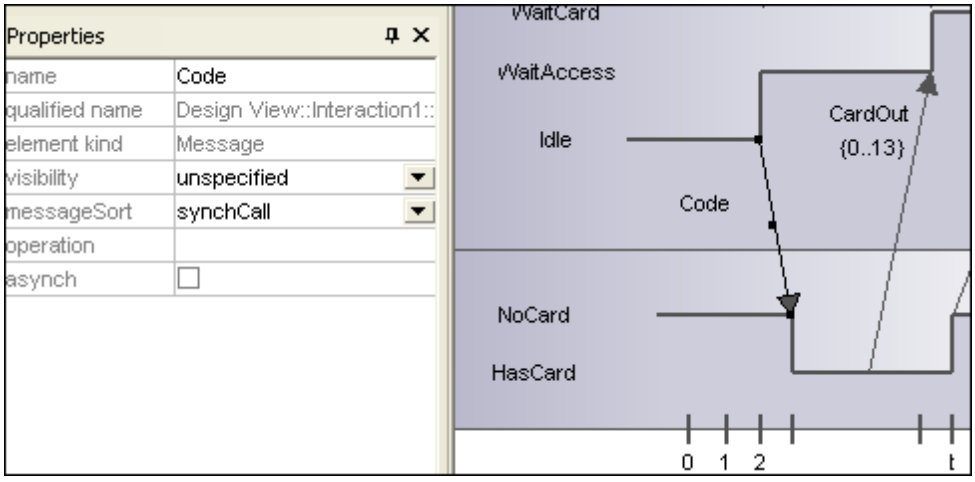
A Message is a modeling element that defines a specific kind of communication in an Interaction. A communication can be e.g. raising a signal, invoking an Operation, creating or destroying an Instance. The Message specifies the type of communication defined by the dispatching ExecutionSpecification, as well as the sender and the receiver.

Messages are sent between sender and receiver timelines, and are shown as labeled arrows.

To insert a message:

1. Click the specific message icon in the toolbar.
2. Click anywhere on the timeline sender object e.g. Idle.
3. Drag and drop the message line onto the receiver objects timeline e.g. NoCard.

   Lifelines are highlighted when the message can be dropped.



- The direction in which you drag the arrow defines the message direction. Reply messages can point in either direction.

- Having clicked a message icon and holding down CTRL, allows you to insert multiple messages by repeatedly clicking and dragging in the diagram tab.

To delete a message:

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1. Click the specific message to select it.
2. Press the Del. key to delete it from the model, or right click it and select "Delete from diagram".

9.2 Structural Diagrams

These diagrams depict the structural elements that make up a system or function. Both the static, e.g. Class diagram, and dynamic, e.g. Object diagram, relationships are presented.

Structural Diagrams

- Class Diagram
- Component Diagram
- Composite Structure Diagram
- Deployment Diagram
- Object Diagram
- Package Diagram
- Profile Diagram

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9.2.1 Class Diagram

This section includes tasks and concepts applicable to Class Diagrams, as follows:

- Customizing Class Diagrams
- Overriding Base Class Operations and Implementing Interface Operations
- Creating Getter and Setter Methods
- Ball and Socket Notation
- Adding Raised Exceptions to Methods of a Class
- Generating Class Diagrams

For a basic introduction to Class Diagrams, see Class Diagrams in the tutorial section of this documentation.

Customizing Class Diagrams

Expanding / hiding class compartments in a UML diagram:

There are several methods of expanding the various compartments of class diagrams.

- Click on the **+** or **-** buttons of the currently active class to expand/collapse the specific compartment.
- Use the marquee (drag on the diagram background) to mark **multiple** classes, then click the expand/hide button. You can also use CTRL+click to select multiple classes.
- Press CTRL+A to select **all classes**, then click the expand/collapse button, on one of the classes, to expand/collapse the respective compartments.

Expanding / collapsing class compartments in the Model Tree:

In the Model Tree classes are subelements of packages and you can affect either the packages or the classes.

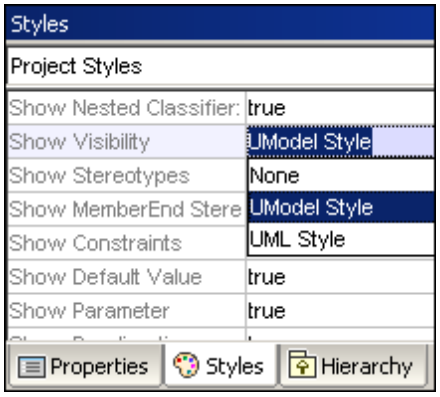
Click the package / class you want to **expand** and:
Press the ***** key to expand the current package/class and all sub-elements
Press the **+** key to open the current package/class.

To **collapse** the packages/classes, press the **-** keyboard key.
Note that you can use the standard keyboard keys, or the numeric keypad keys to achieve this.

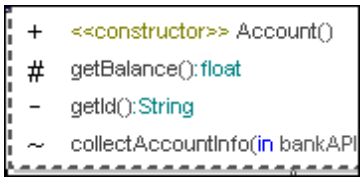
Changing the visibility type icons

Clicking the **visibility icon** to the left of an operation , or property , opens a drop-down list enabling you to change the visibility status. You can also change the type of visibility symbols that you want to see.

- Click a class in the diagram window, click the **Styles** tab and scroll down the list until you find the **Show Visibility** entry.



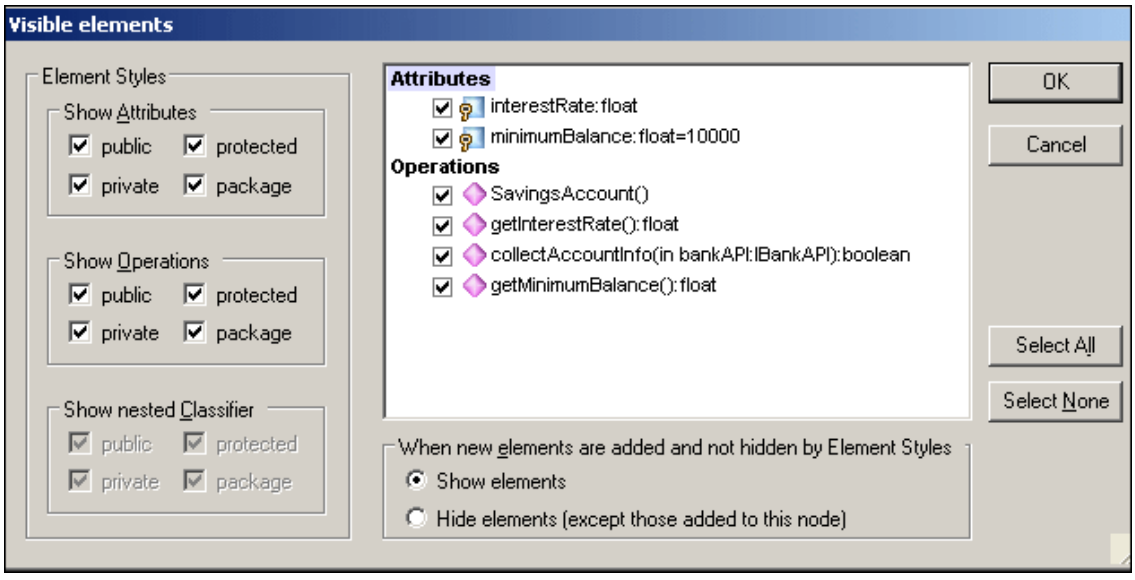
You can choose between the UModel type shown above, or the UML conformant symbols shown below.



Showing / Hiding node content (class attributes, operations, slots)

UModel now allows you to individually display the attributes or operations of a class, as well as define which should be shown when adding them as new elements. Note that this it now possible to show/hide object slots i.e. InstanceSpecifications using the same method.

Right click a class, e.g. SavingsAccount, and select the menu option **Show/Hide Node content**.



Deselecting a **protected** checkbox in the **Attributes** group, deselects the protected attributes in the preview window.

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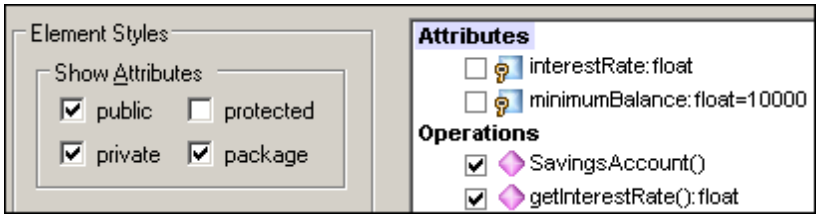
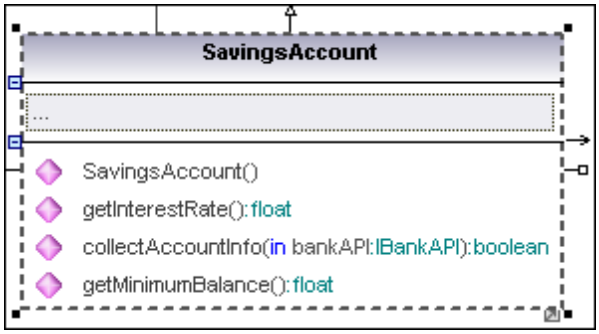


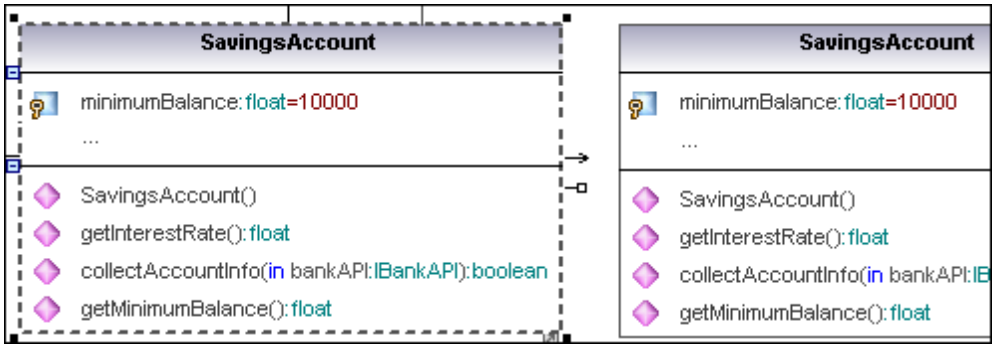
Having confirmed with OK, the protected attributes in the class are replaced with ellipsis "...". Double clicking the ellipsis opens the dialog box.



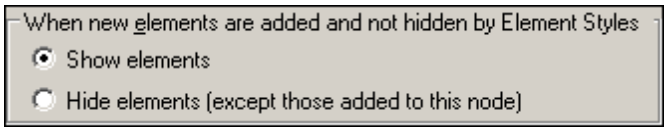
Note that individual attributes can be affected by only deselecting the check box in the preview window.

Showing / Hiding class attributes or operations - Element styles

UModel allows you to insert **multiple instances** of the same class on a **single** diagram, or even different diagrams. The visibility settings can be individually defined for each of these "views" to the class. The screenshot below shows two views to the same class i.e. SavingsAccount.



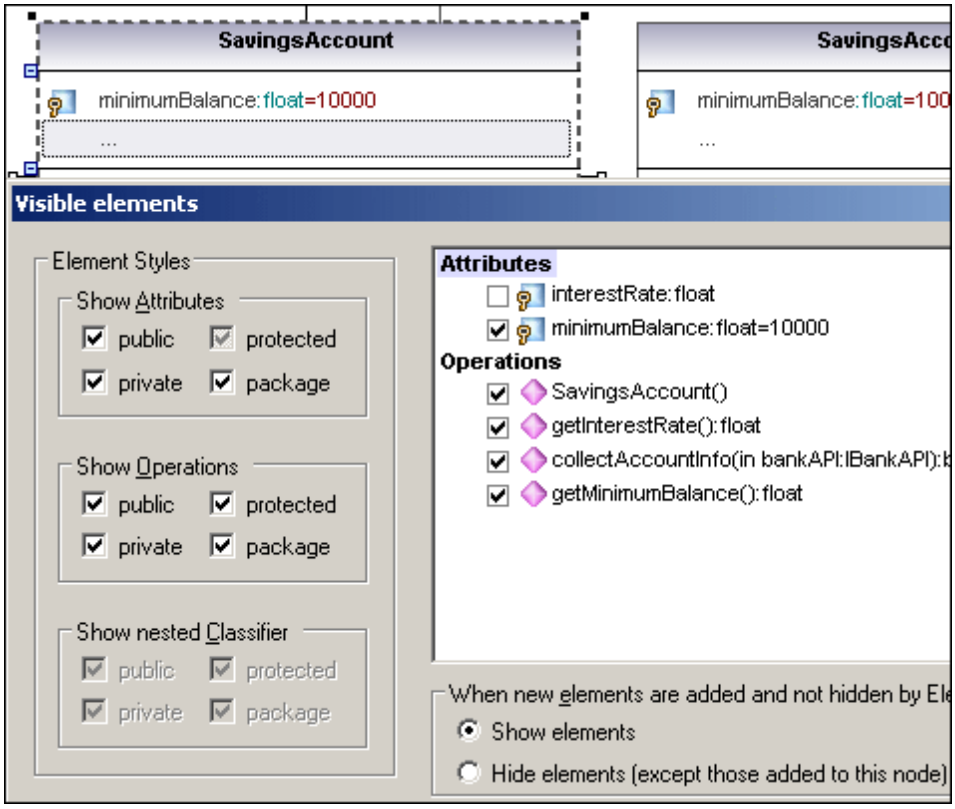
The "When new elements are added and not hidden by Element Styles" option allows you to define what will be made visible when new elements are added to the class. Elements can be added manually in the model diagram and in the Model Tree, or automatically during the code engineering process.


When new elements are added and not hidden by Element Styles
Show elements
Hide elements (except those added to this node)

Show elements: displays all new elements that are added to any view of the class.

E.g. The interestRate:float attribute has been hidden in both "views" of SavingsAccount, leaving the minimumBalance attribute visible. The "Show elements" radio button is active for the left-hand class.

Double clicking the ellipsis "..." in the attribute compartment of the **left**-hand class shows that the "Show elements" radio button is active.



Double clicking the ellipsis "..." in the attribute compartment of the **right**-hand class shows that the "Hide elements (except those added to this node)" radio button is active.

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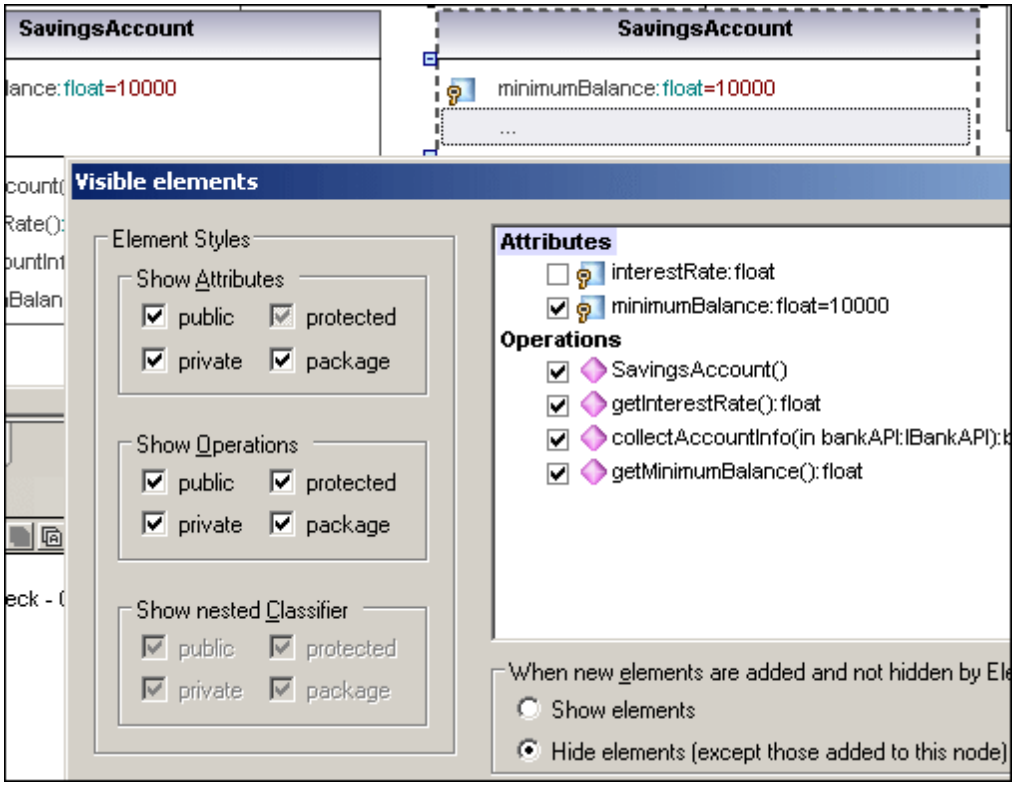
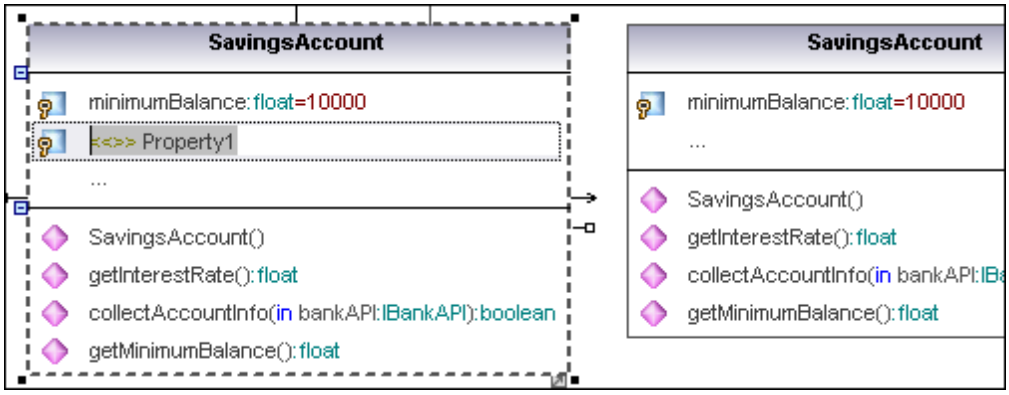
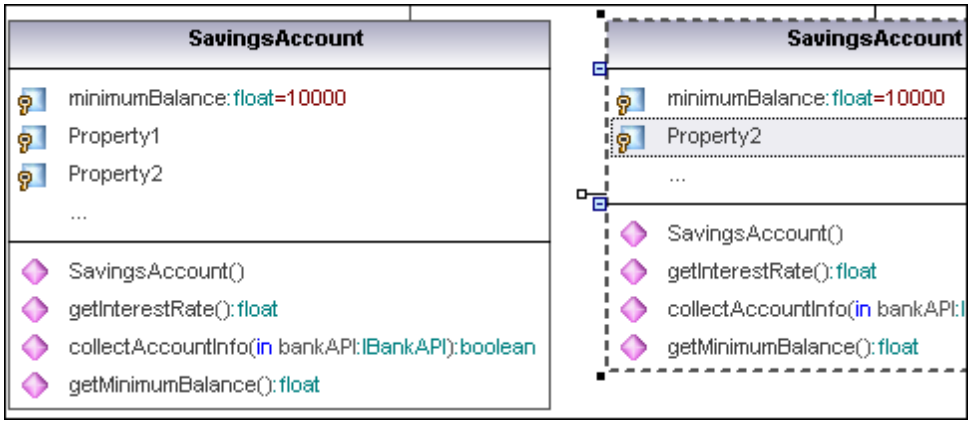


Clicking the **left**-hand class and pressing F7, (or clicking the class in the Model Tree and pressing F7) adds a new attribute (Property1) to the class.



The new element is only visible in the left-hand class, because "Show elements" is set as active. The right-hand class setting is "Hide elements...", so the new element is not shown there.

Clicking the **right**-hand class and pressing F7 adds a new attribute (Property2) to the class. This new attribute is now visible because the Hide elements... setting has the qualifier "**except those added to this node**", where "node" generically means this class, or modelling element.

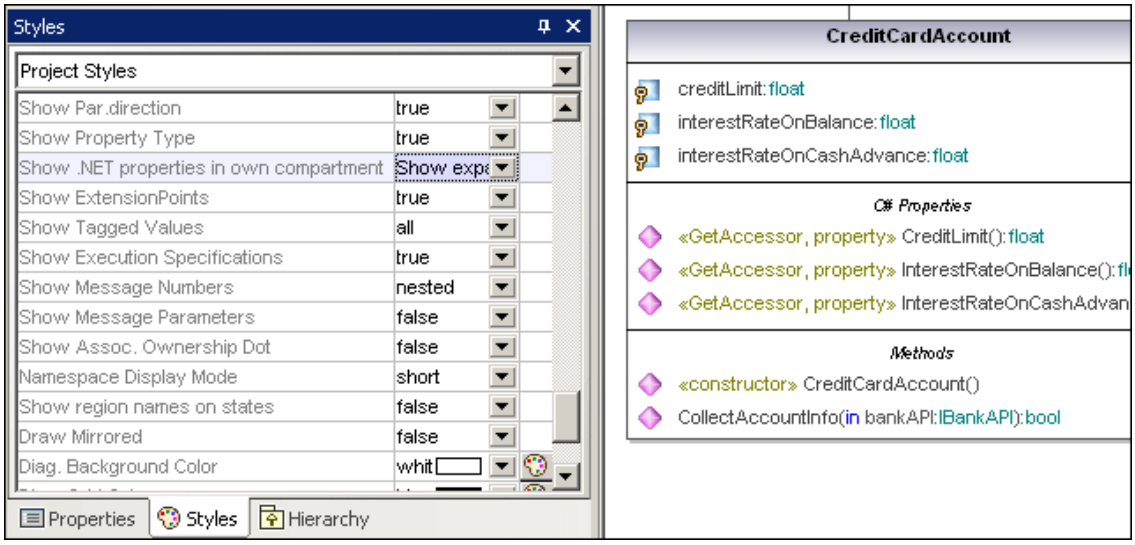


The Property2 attribute is also visible in the left hand class, because the setting there is "Show elements"

Please note:
Tagged values of hidden elements are also hidden when you select the hide option.

Showing / Hiding VS .NET compartments:

UModel can now display .NET properties in their own compartment, by selecting the "Show .NET properties in own compartment" option in the Styles tab.



Showing VS .NET properties as associations

UModel can now display .NET properties as associations.
Right click a C# property as shown below, and select "Show | All .NET Properties as Associations" drag and drop the operation onto the diagram.

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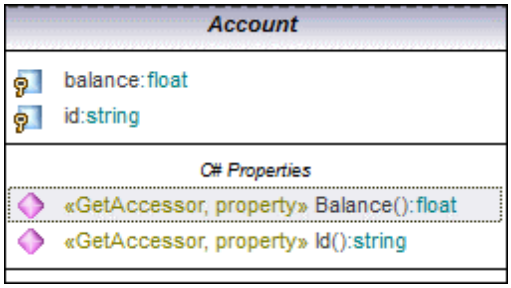
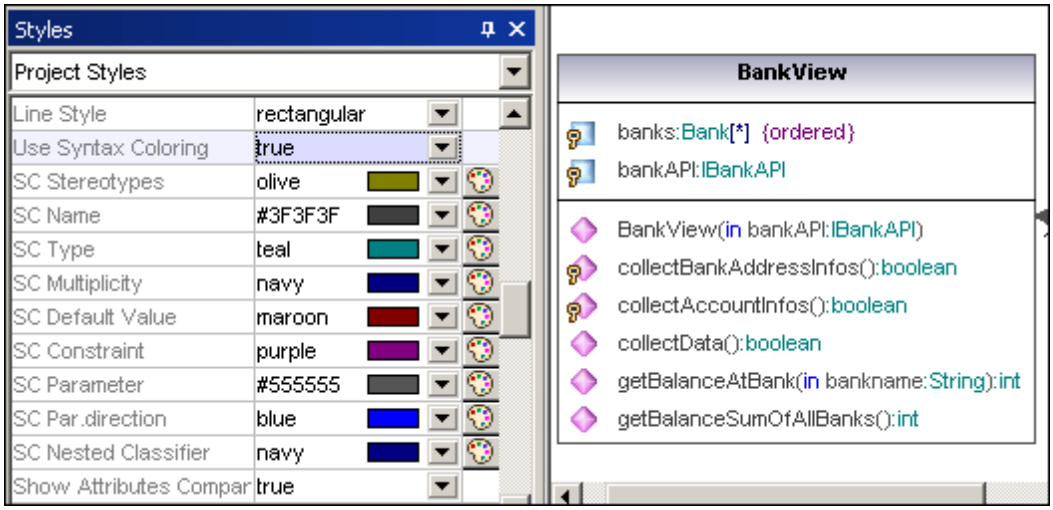


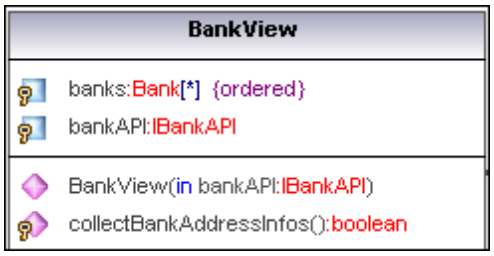
Changing the syntax coloring of operations/properties

UModel automatically enables syntax coloring, but lets you customize it to suit your needs. The default settings are shown below.



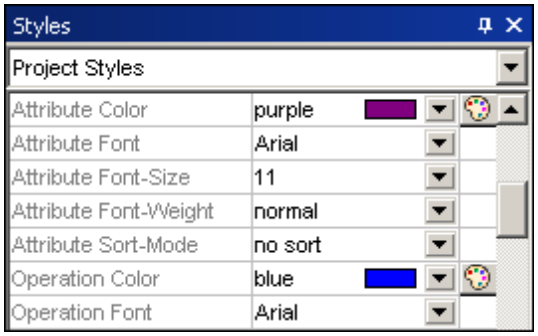
To change the default syntax coloring options (shown below):

1. Switch to the Styles tab and scroll the **SC** prefixed entries.
2. Change one of the SC color entries e.g. SC Type to red.



To disable syntax coloring:

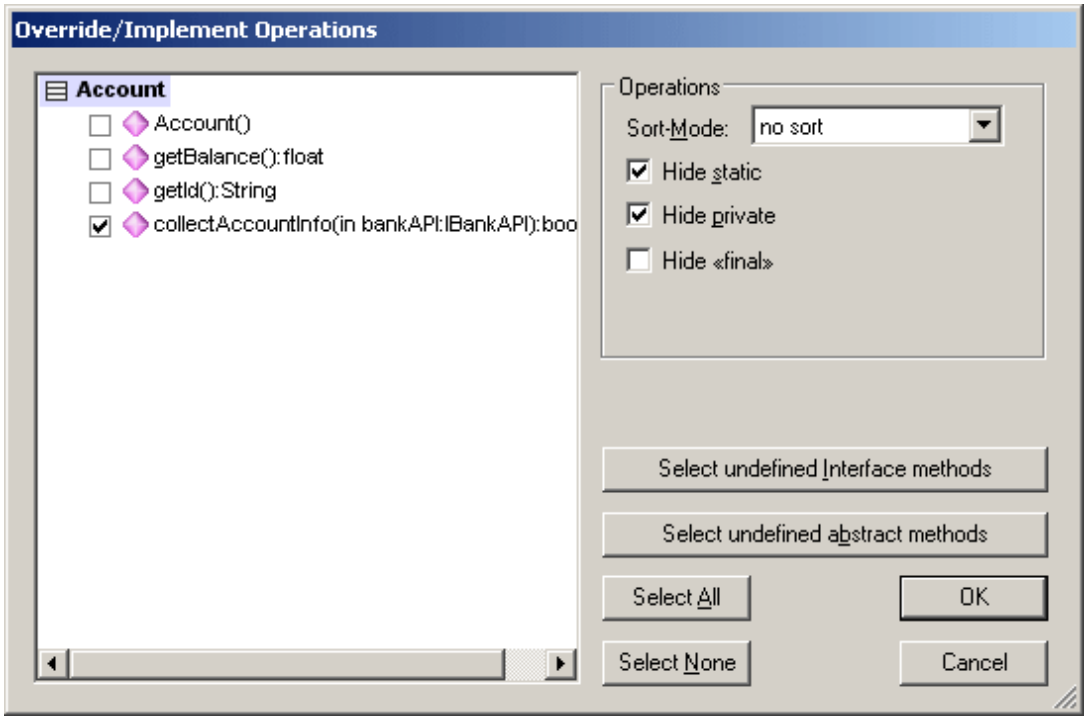
1. Switch to the Styles tab and change the **Use Syntax Coloring** entry to **false**.
2. Use the **Attribute Color**, or **Operation Color** entries in the Styles tab to customize these items in the class.



Overriding Base Class Operations and Implementing Interface Operations

UModel gives you the ability to override the base-class operations, or implement interface operations of a class. This can be done from the Model Tree, Favorites tab, or in Class diagrams.

1. Right click one of the derived classes in the class diagram, e.g. CheckingAccount, and select **Override/Implement Operations**.
   This opens the Overriden Methods dialog box shown below.



2. Select the Operations that you want to override and confirm with OK.
   The "Select undefined..." buttons select those method types in the window at left.

Please note:

When the dialog box is opened, operations of base classes and implemented interfaces that have the same signature as existing operations, are automatically checked (i.e. active).

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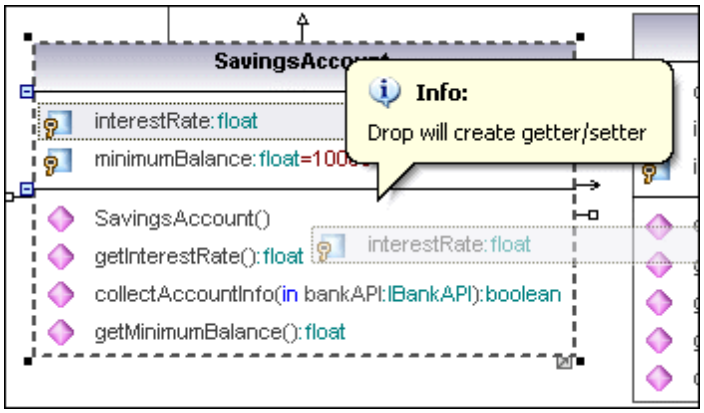
Creating Getter and Setter Methods

During the modeling process it is often necessary to create get/set methods for existing attributes. UModel supplies you with two separate methods to achieve this:

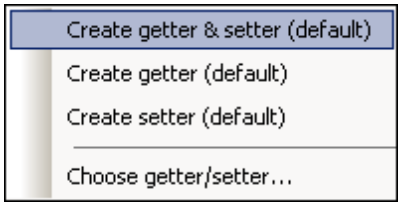
- Drag and drop an attribute into the operation compartment
- Use the context menu to open a dialog box allowing you to manage get/set methods

To create getter/setter methods using drag and drop:

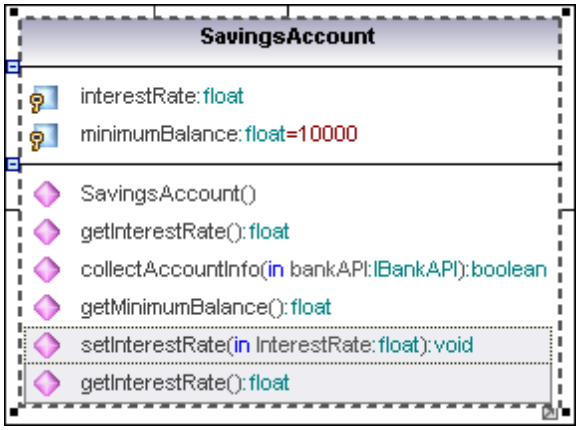
1. Drag an attribute from the Attribute compartment and drop it in the Operations compartment.



A popup appears at this point allowing you to decide what type of get/set method you want to create.

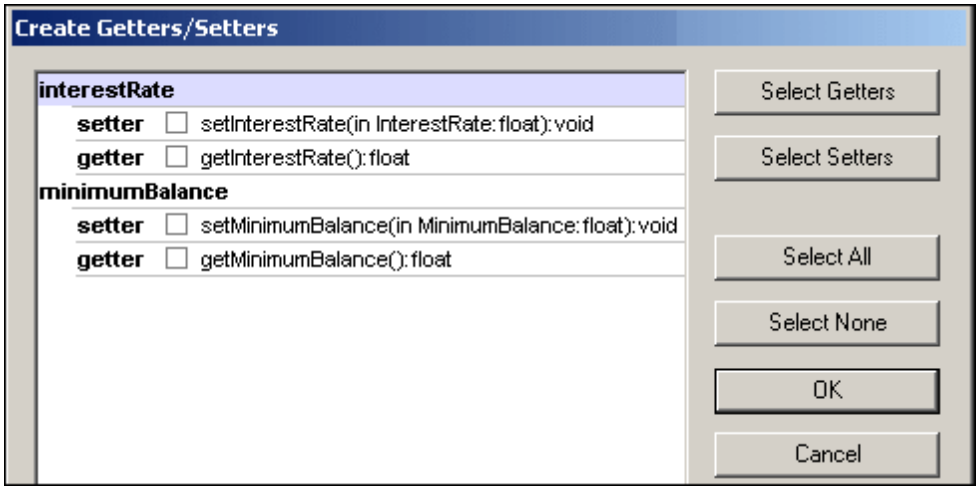


Selecting the first item creates a get and set method for interestRate:float.



To create getter/setter methods using the context menu:

1. Right click the class title, e.g. SavingsAccount, and select the context menu option **Create Getter/Setter Operations**.



The Create Getters/Setters dialog box opens displaying all attributes available in the currently active class.

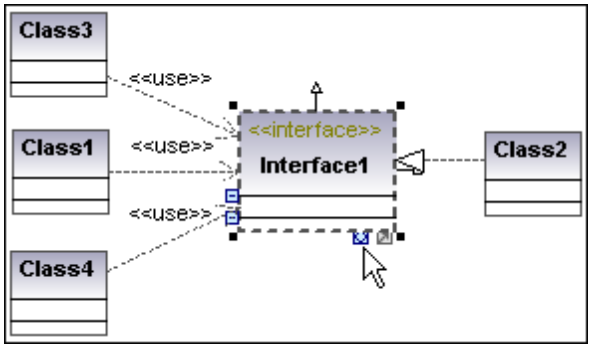
2. Use the buttons to select the items as a group, or click the getter/setter check boxes individually.

Please note:

You can also right click a single attribute and use the same method to create an operation for it.

Ball and Socket Notation

UModel supports the ball and socket notation of UML. Classes that require an interface display a "socket" and the interface name, while classes that implement an interface display the "ball".



In the shots shown above, Class2 realizes Interface1, which is used by classes 1, 3, and 4. The usage icons were used to create the usage relationship between the classes and the interface.

To switch between the standard and ball-and-socket view:

- Click the Toggle Interface notation icon at the base of the interface element.

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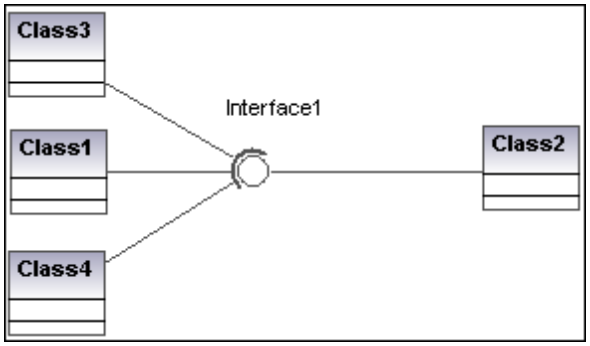
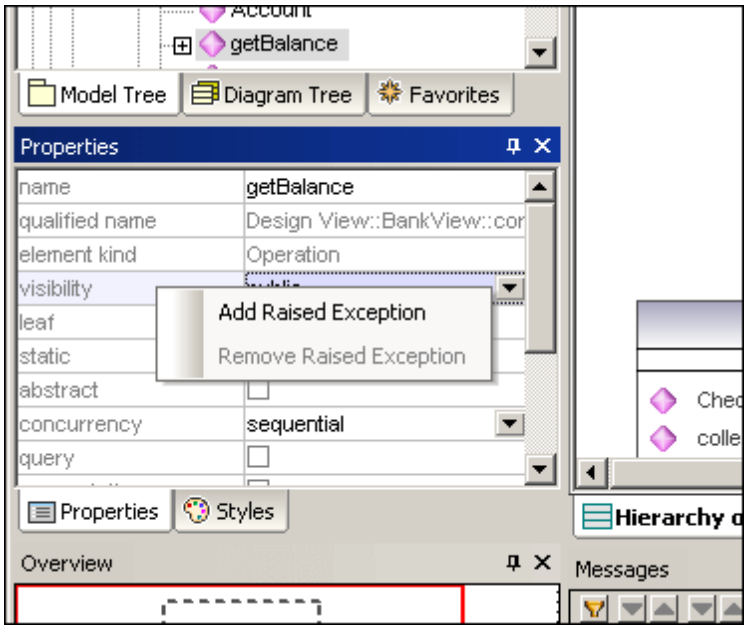


Adding Raised Exceptions to Methods of a Class

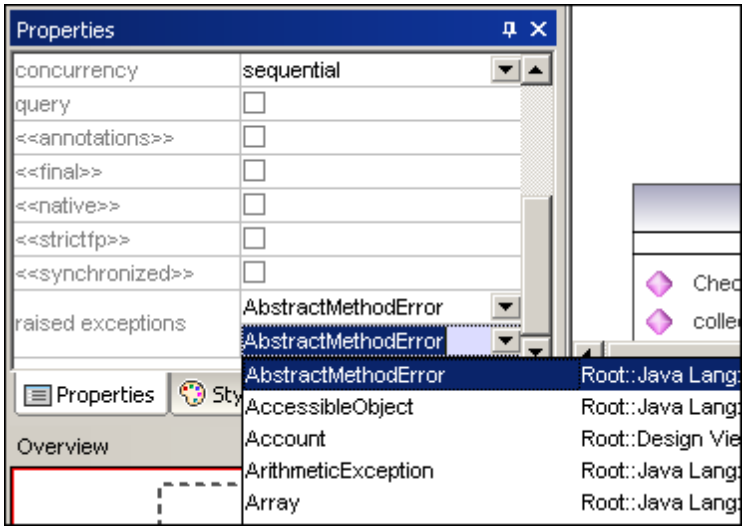
Adding Raised Exceptions to methods of a class

1. Click the method of the class you want to add the raised exception to in the Model Tree window, e.g. getBalance of the Account class.
2. Right click in the Properties window and select **Add Raised Exception** from the popup menu.



This adds the raised exceptions field to the Properties window, and automatically selects the first entry in the popup menu.

3. Select an entry from the popup, or enter your own into the field.



Generating Class Diagrams

As an alternative to designing Class Diagrams directly in UModel, you can generate them automatically when importing source code or binaries into UModel projects (see Importing source code into projects and Importing Java, C# and VB binaries). When following the import wizard, make sure that:

1) The **Enable diagram generation** check box is selected on the "Import Source Project", "Import Binary Types", or "Import Source Directory" dialog box.

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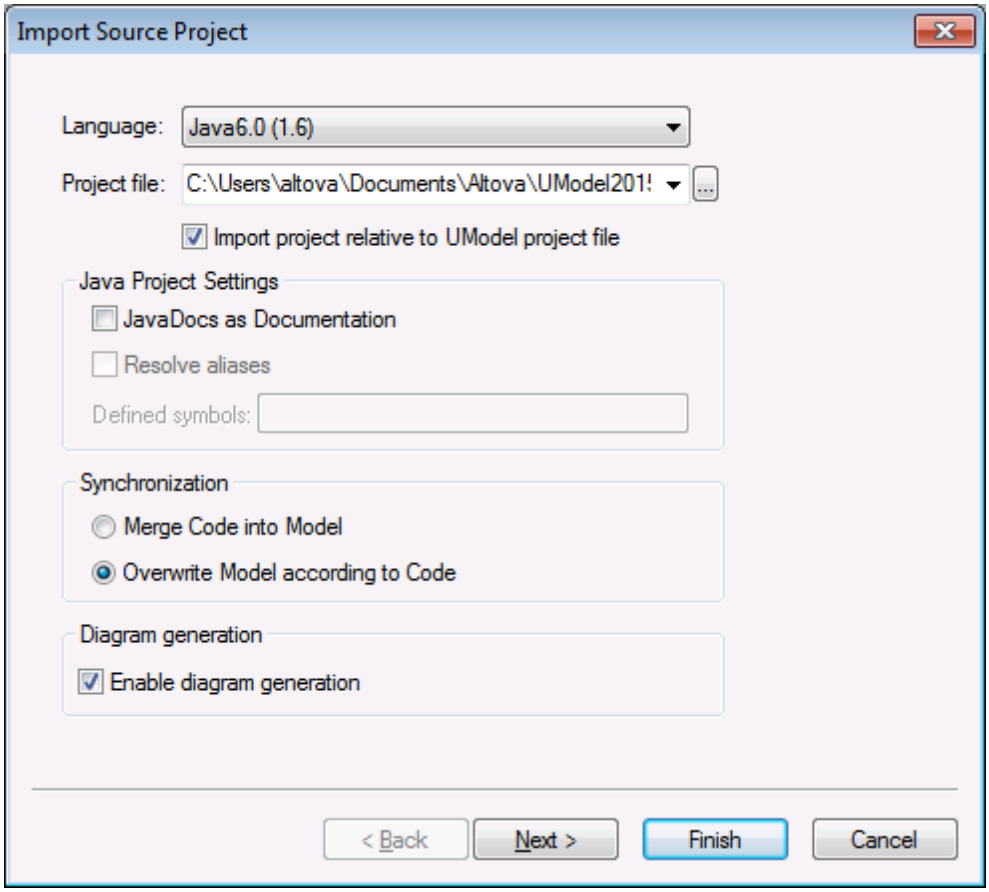
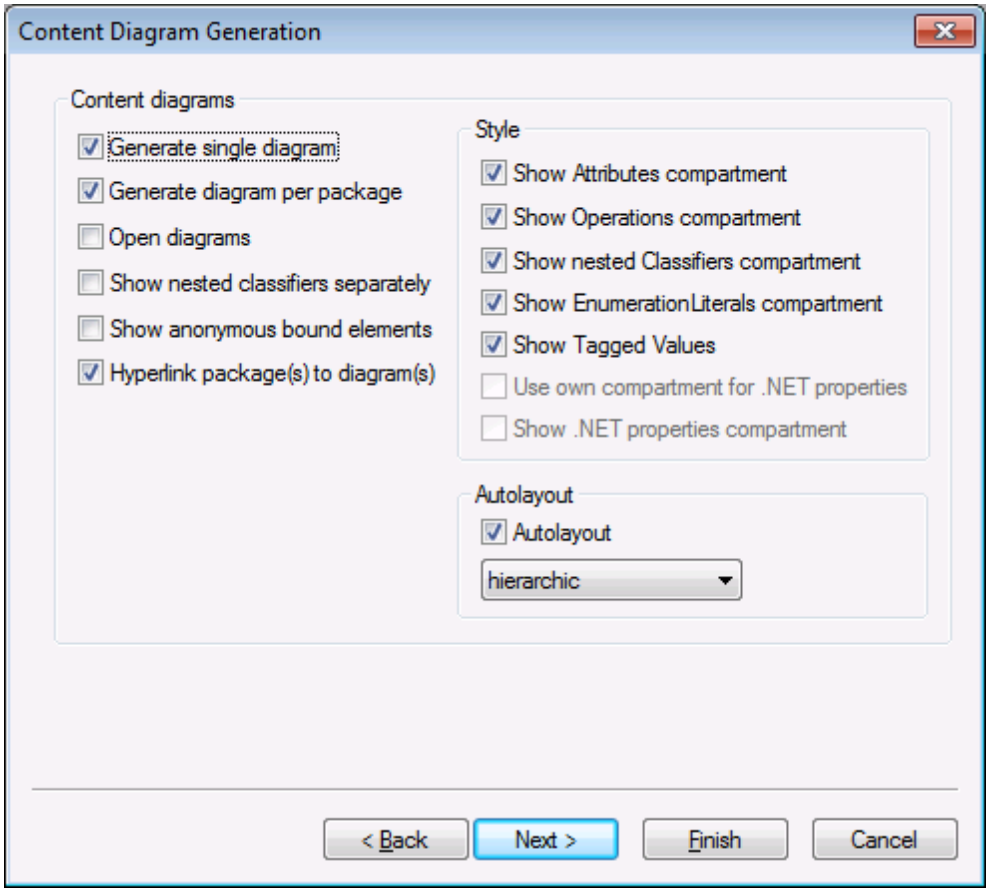


Import Source Project dialog box

2) The **Generate single diagram** and/or the **Generate diagram per package** options are selected on the "Content Diagram Generation" dialog box.



Content Diagram Generation dialog box

Once the import operation is finished, any generated class diagrams are available under "Class Diagrams" in the Diagram Tree.

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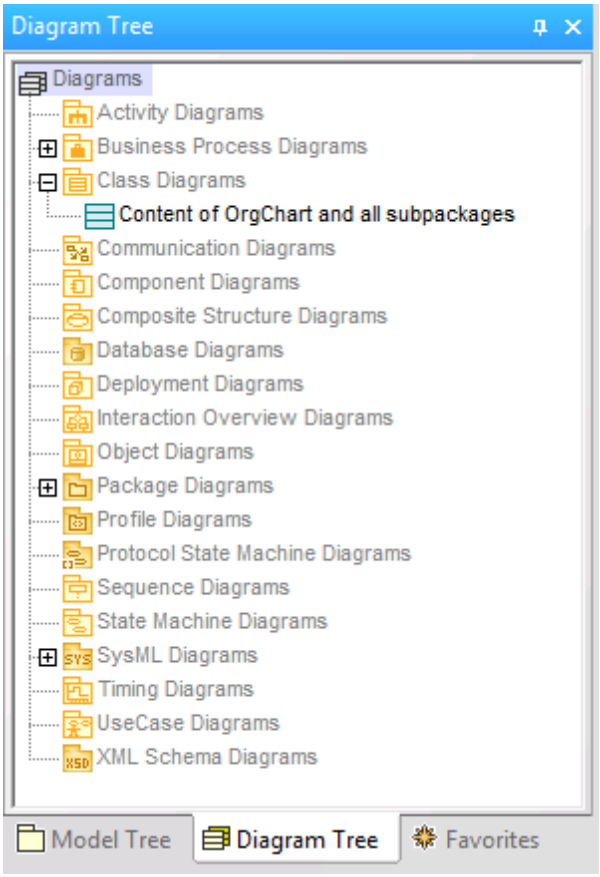
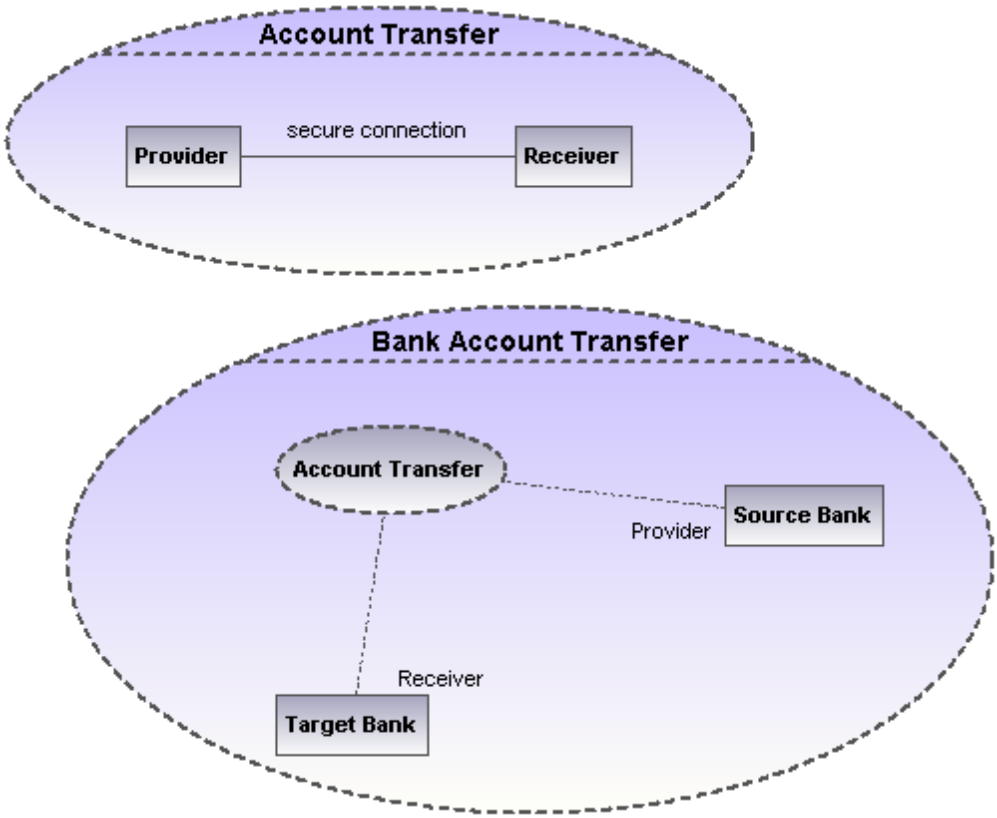


Diagram Tree

9.2.2 Composite Structure Diagram

Altova web site: UML Composite Structure diagrams

The Composite Structure Diagram has been added in UML 2.0 and is used to show the internal structure, including parts, ports and connectors, of a structured classifier, or collaboration.



Inserting Composite Structure Diagram elements

Using the toolbar icons:

1. Click the specific Composite Structure diagram icon in the toolbar.
2. Click in the Composite Structure diagram to insert the element.
   Note that holding down CTRL and clicking in the diagram tab, allows you to insert multiple elements of the type you selected.

Dragging existing elements into the Composite Structure diagram:

Most elements occurring in other Composite Structure diagrams, can be inserted into an existing Composite Structure diagram.

1. Locate the element you want to insert in the Model Tree tab (you can use the search function text box, or press CTRL+F, to search for any element).
2. Drag the element(s) into the Composite Structure diagram.

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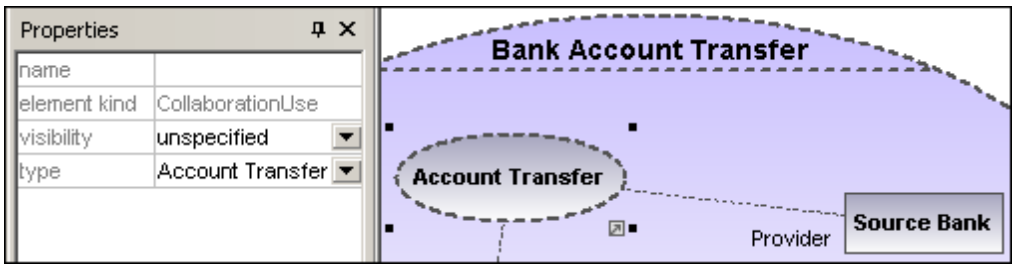
Collaboration
Inserts a collaboration element which is a kind of classifier/instance that communicates with other instances to produce the behavior of the system.

CollaborationUse
Inserts a Collaboration use element which represents one specific use of a collaboration involving specific classes or instances playing the role of the collaboration. A collaboration use is shown as a dashed ellipse containing the name of the occurrence, a colon, and the name of the collaboration type.



When creating dependencies between collaboration use elements, the "type" field must be filled to be able to create the role binding, and the target collaboration must have at least one part/role.

Part (Property)
Inserts a part element which represents a set of one or more instances that a containing classifier owns. A Part can be added to collaborations and classes.

Port
Inserts a port element which defines the interaction point between a classifier and its environment, and can be added on parts with a defined type.

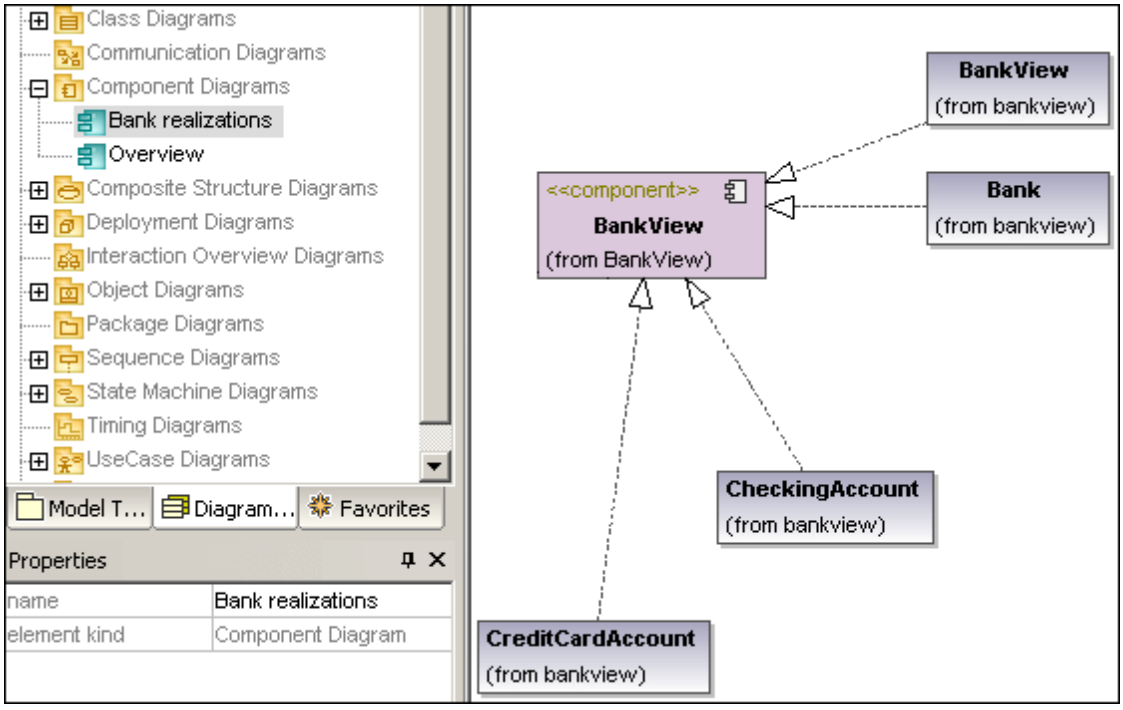
Class
Inserts a Class element, which is the actual classifier that occurs in that particular use of the collaboration.

Connector
Inserts a Connector element which can be used to connect two or more instances of a part, or a port. The connector defines the relationship between the objects and identifies the communication between the roles.

Dependency (Role Binding)
Inserts the Dependency element, which indicates which connectable element of the classifier or operation, plays which role in the collaboration.

9.2.3 Component Diagram

Please see the Component Diagrams section in the tutorial for more information on how to add component elements to the diagram.



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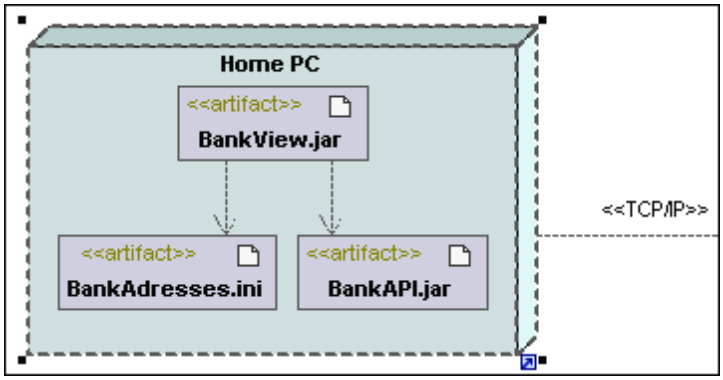
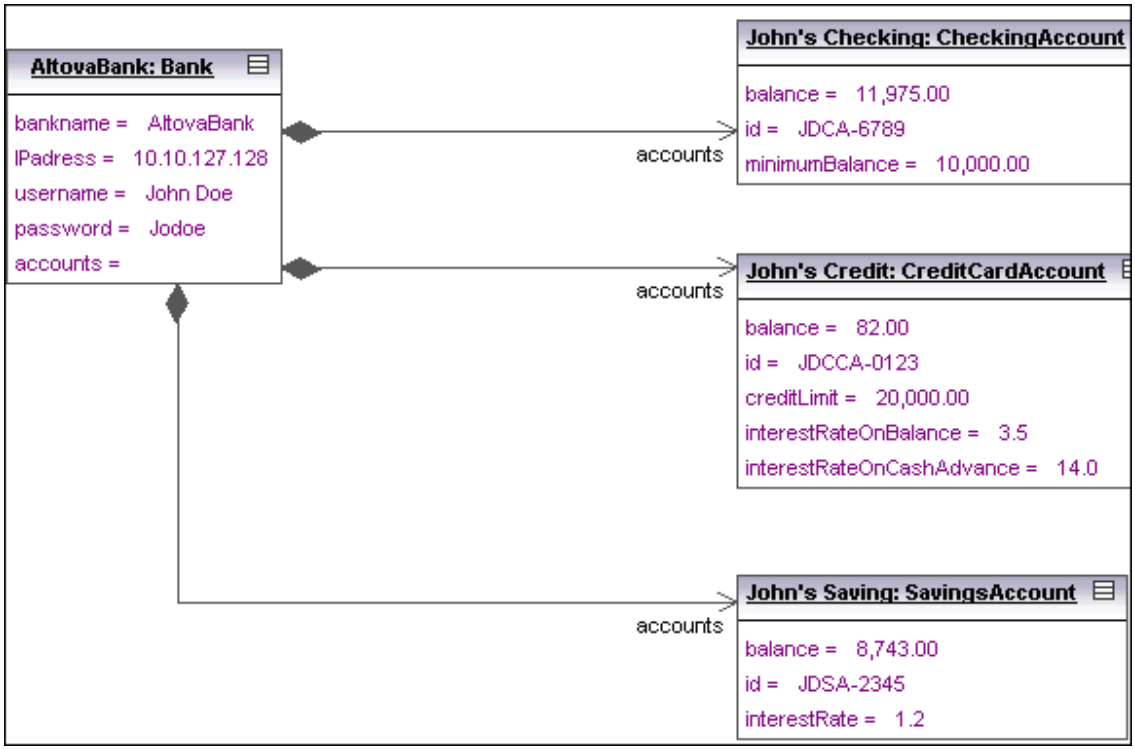
9.2.4 Deployment Diagram

Please see the Deployment Diagrams section in the tutorial for more information on how to add nodes and artifacts to the diagram.



9.2.5 Object Diagram

Please see the Object Diagrams section in the tutorial for more information on how to add new objects/instances to the diagram.



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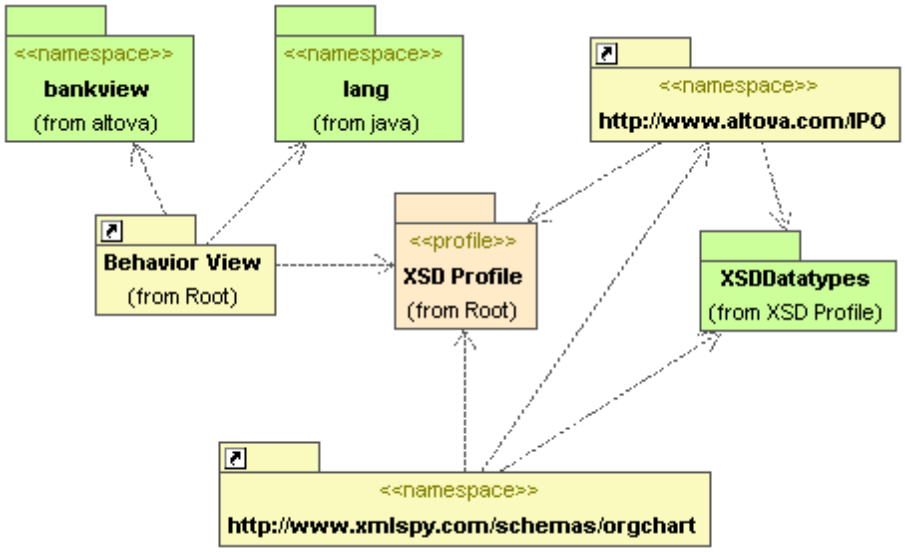
9.2.6 Package Diagram

Package diagrams display the organization of packages and their elements, as well as their corresponding namespaces. UModel additionally allows you to create a hyperlink and navigate to the respective package content.

Packages are depicted as folders and can be used on any of the UML diagrams, although they are mainly used on use-case and class diagrams.



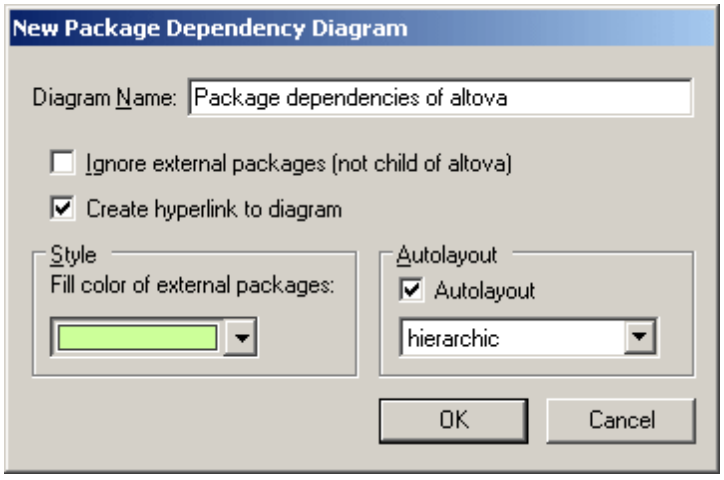
Automatic Package Dependency diagram generation

You can generate a package dependency diagram for any package that already exists in the Model Tree.

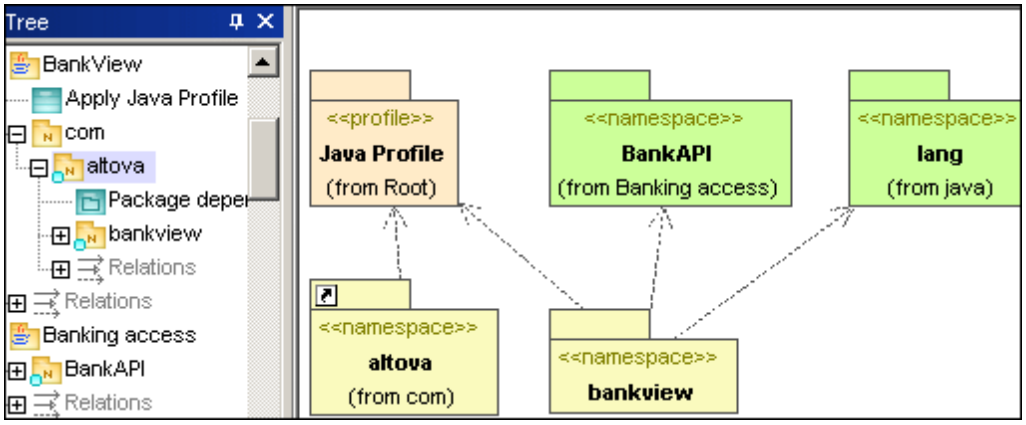
Dependency links between packages are created if there are any references between the modeling elements of those packages. E.g. Dependencies between classes, derived classes, or if attributes have types that are defined in a different package.

To generate a package dependency diagram:

1. Right click a package in the Model Tree, e.g. altova, and select **Show in new Diagram | Package Dependencies...**.
   This opens the New Package Dependency Diagram dialog box.



2. Select the specific options you need and click OK to confirm.



A new diagram is generated and displays the package dependencies of the altova package.

Inserting Package Diagram elements

Using the toolbar icons:

1. Click the specific icon in the Package Diagram toolbar.

2. Click in the diagram to insert the element.
   Note that holding down CTRL and clicking in the diagram tab, allows you to insert multiple elements of the type you selected.

Dragging existing elements into the Package Diagram:

Elements occurring in other diagrams, e.g. other packages, can be inserted into a Package diagram.

1. Locate the element you want to insert in the Model Tree tab (you can use the search function text box, or press CTRL+F, to search for any element).
2. Drag the element(s) into the diagram.

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Package
Inserts the package element into the diagram. Packages are used to group elements and also to provide a namespace for the grouped elements. Being a namespace, a package can import individual elements of other packages, or all elements of other packages. Packages can also be merged with other packages.

Profile
Inserts the Profile element, which is a specific type of package that can be applied to other packages.

The Profiles package is used to extend the UML meta model. The primary extension construct is the Stereotype, which is itself part of the profile. Profiles must always be related to a reference meta model such as UML, they cannot exist on their own.

Dependency
Inserts the Dependency element, which indicates a supplier/client relationship between modeling elements, in this case packages, or profiles.

PackageImport
Inserts an <<import>> relationship which shows that the elements of the included package will be imported into the including package. The namespace of the including package gains access to the included namespace; the namespace of the included package is not affected.

Note: elements defined as "private" within a package, cannot be merged or imported.

PackageMerge
Inserts a <<merge>> relationship which shows that the elements of the merged (source) package will be imported into the merging (target) package, including any imported contents the merged (source) package.

If the same element exists in the target package then these elements' definitions will be expanded by those from the target package. Updated or added elements are indicated by a generalization relationship back to the source package.
Note: elements defined as "private" within a package, cannot be merged or imported.

ProfileApplication
Inserts a Profile Application which shows which profiles have been applied to a package. This is a type of package import that states that a Profile is applied to a Package.

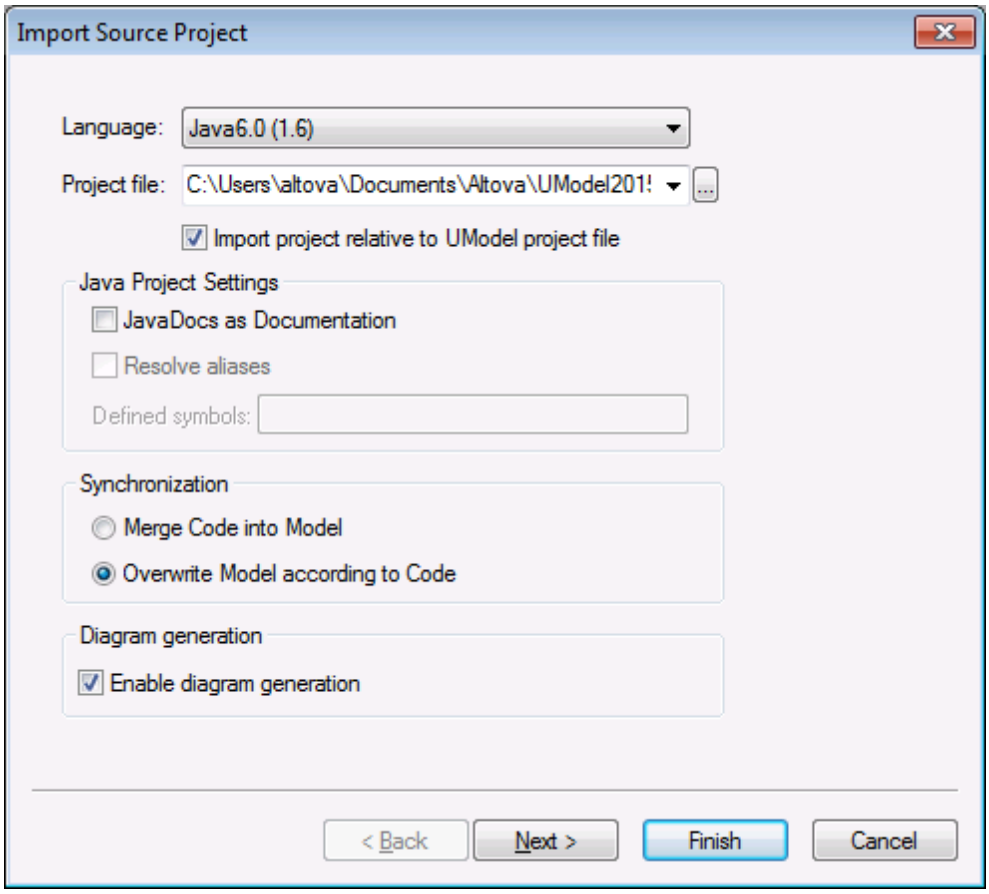
The Profile extends the package it has been applied to. Applying a profile, using the ProfileApplication icon, means that all stereotypes that are part of it, are also available to the package.

Profile names are shown as dashed arrows from the package to the applied profile, along with the <<apply>> keyword.

Generating Package Diagrams While Importing Code or Binaries

You can instruct UModel to generate package diagrams when importing source code or binaries into the UModel project (see Importing source code into projects and Importing Java, C# and VB binaries). When following the import wizard, make sure that:

1) The **Enable diagram generation** check box is selected on the "Import Source Project", "Import Binary Types", or "Import Source Directory" dialog box.



Import Source Project dialog box

2) The **Generate diagram** option is selected on the "Package Dependency Diagram Generation" dialog box.

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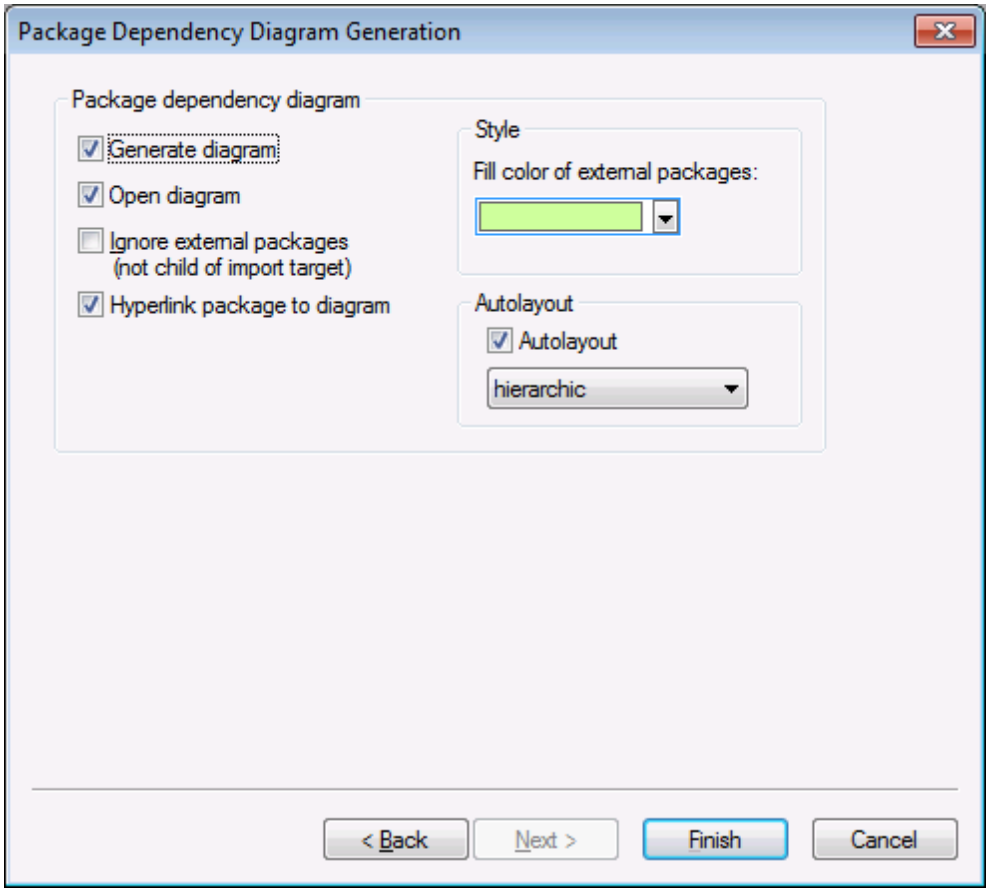

Package Dependency Diagram Generation dialog box

Once the import operation is finished, any generated package diagrams are available under "Package Diagrams" in the Diagram Tree.

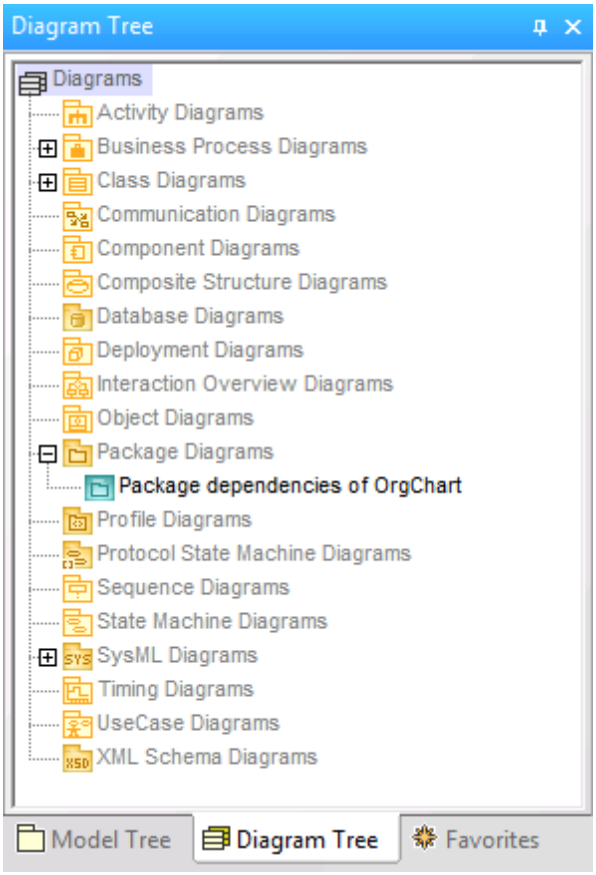

Diagram Tree

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9.2.7 Profile Diagram and stereotypes

Altova web site: UML profile diagrams

The UModel Profile diagram allows you to define custom stereotypes, tagged values and constraints in a dedicated diagram.

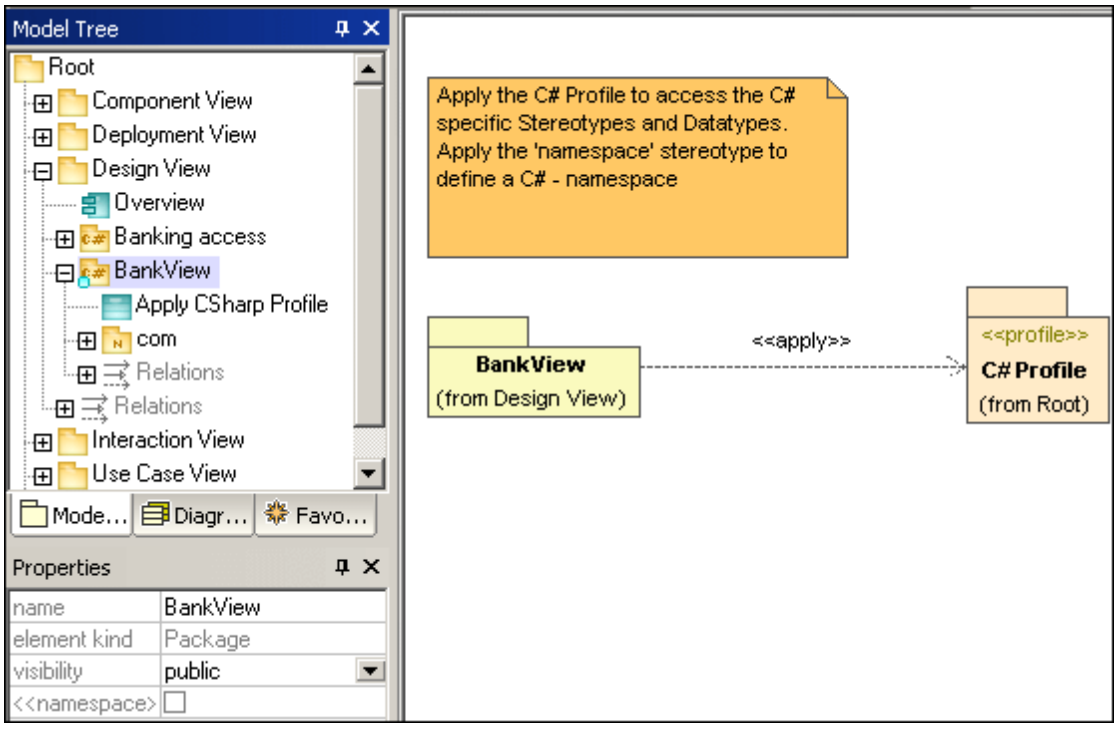
Profiles and stereotypes are used to extend the UML meta model. The primary extension construct is the Stereotype, which is itself part of the profile. Profiles must always be related to a reference meta model such as UML, they cannot exist on their own. UModel now supports the Profile Diagram in which you can define your own stereotypes.

The Java Profile.ump (C# Profile.ump, or VB Profile.ump) file need to be applied when creating new UModel projects using the menu item **Project | Include Subproject**. **This profile supplies the Java datatypes and stereotypes, and is essential when creating code for round-trip engineering.**

The following sections describe:

- Adding Stereotypes and defining tagged values
- Stereotypes and enumerations
- User-defined stereotype styles

The **Bank_CSharp.ump** sample file (in the ...**UModelExamples** folder) shows how this is done. The C# profile has been applied to the BankView package.



- Profiles are specific types of packages, that are applied to other packages.
- Stereotypes are specific metaclasses, that extend standard classes.
- "Tagged values" are values of stereotype attributes.

A ProfileApplication shows which profiles have been applied to a package, and is a type of package import that states that a Profile is applied to a Package. The Profile extends the package it has been applied to. Applying a profile, using the ProfileApplication icon , means that all stereotypes that are part of it, are also available to the package.

ProfileApplications are shown as dashed arrows from the package **to** the applied profile, along with the <<apply>> keyword.

Stereotypes:
A stereotype defines how an existing metaclass may be extended. It is a kind of class that extends Classes through Extensions. Stereotypes can only be created in Profiles. Stereotypes are displayed as classes, in class diagrams, with the addition of the keyword <<stereotype>> added above the name of the class.

- Stereotypes may have **properties**, which are called "**tag definitions**"
- When the stereotype is applied to a model element, the property **values** are called "**tagged values**"
- When stereotypes containing properties are applied, the tagged values are automatically displayed in a comment element (shown below). Please see Tagged values for more info on how to customize the tagged values view
- Stereotypes have their own style family
- If the attribute is of type "enumeration", then an popup menu allows you to select from the predefined values. You can also enter/select the specific value in the Properties tab e.g. <<GetAccessor>> visibility = public, protected etc.

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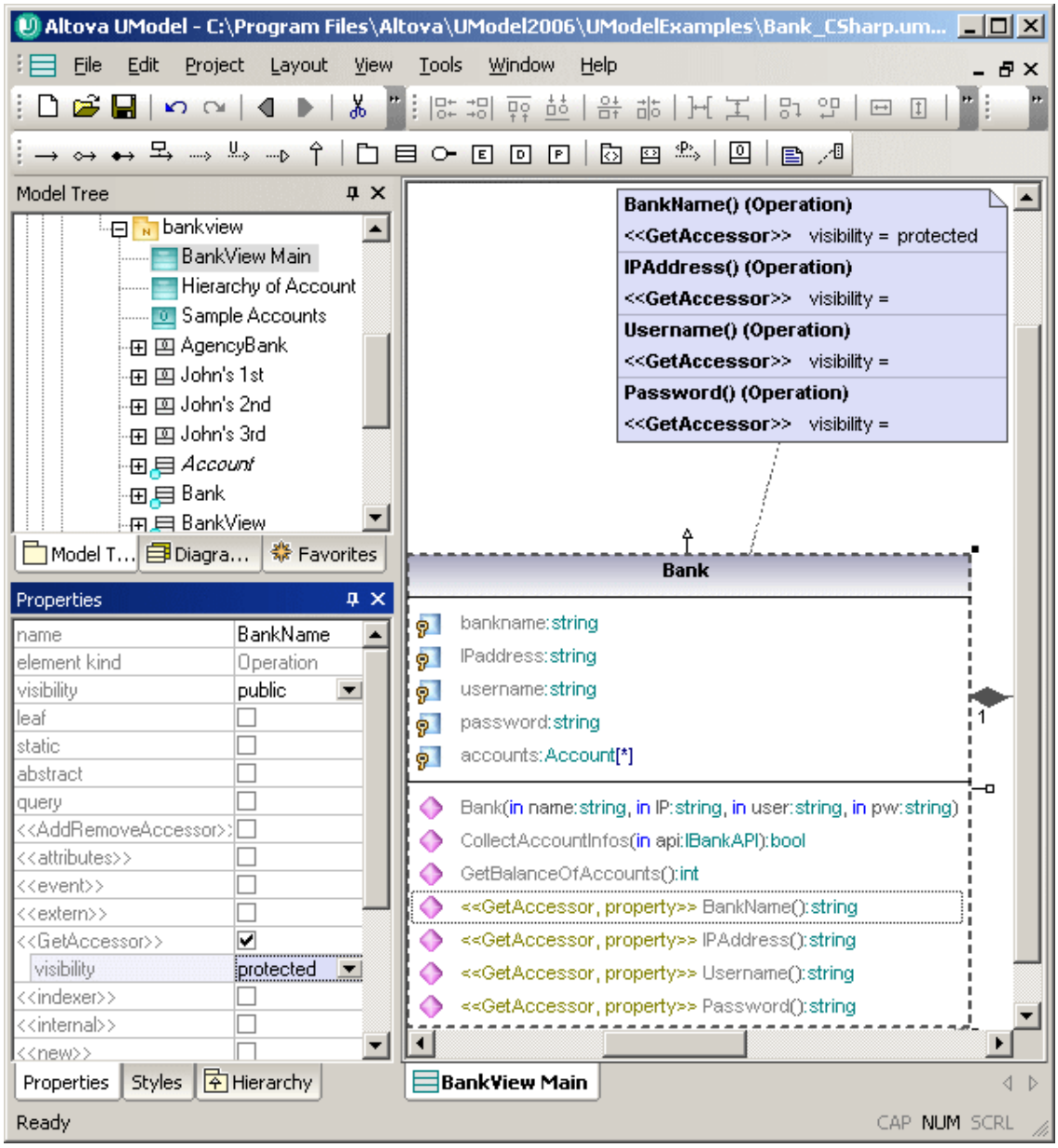
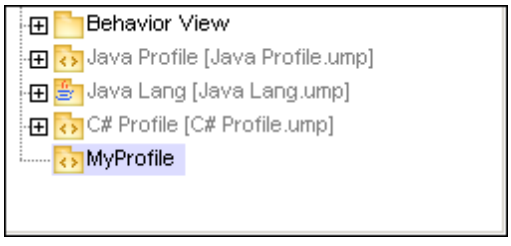


Adding Stereotypes and defining tagged values

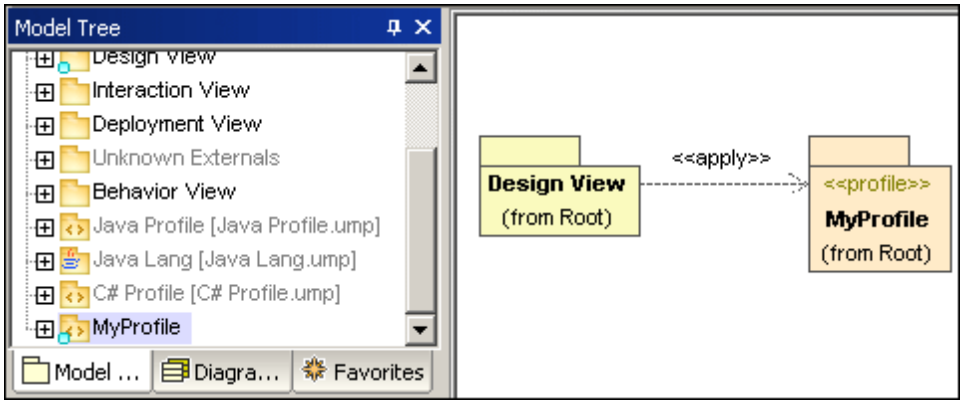
This section uses the Bank_MultiLanguage.ump file available in the ...**UModelExamples** folder.

Creating a Profile diagram and a stereotype

1. Create a new profile in the Model Tree view, e.g. right click the Root package and select **New element | Profile** and name it "MyProfile".

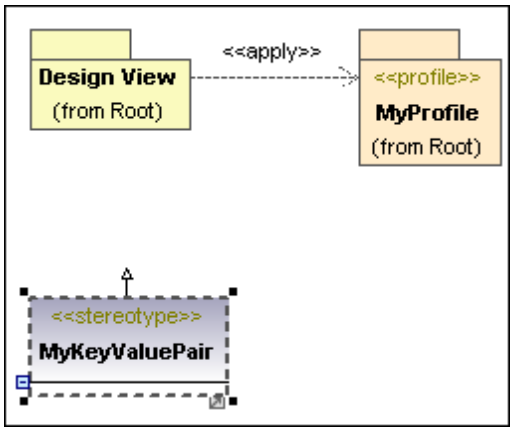


2. Right click the **MyProfile** package in the Model Tree and select **New Diagram | Profile diagram**.
   This adds the Profile diagram to the selected package.
3. Drag the newly created profile "MyProfile", from the Model Tree into the new Profile diagram.
4. Drag the **DesignView** package into the Profile diagram as well.
5. Click the ProfileApplication icon in the icon bar, select the DesignView package and drag the connector onto the MyProfile package.



This allows the stereotypes defined in this profile (MyProfile) to be used in the DesignView package, or any of its subpackages.

6. Click the stereotype icon in the icon bar and insert a stereotype "class", e.g. MyKeyValuePair.



7. Press F7 to add an attribute to the stereotype e.g. **MyKey1**. Do the same thing to add **MyKey2**.

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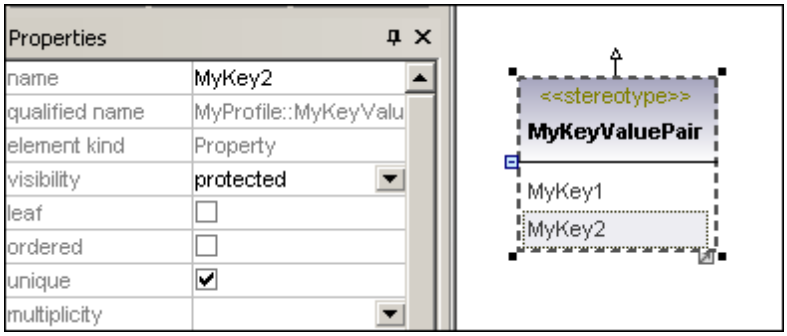
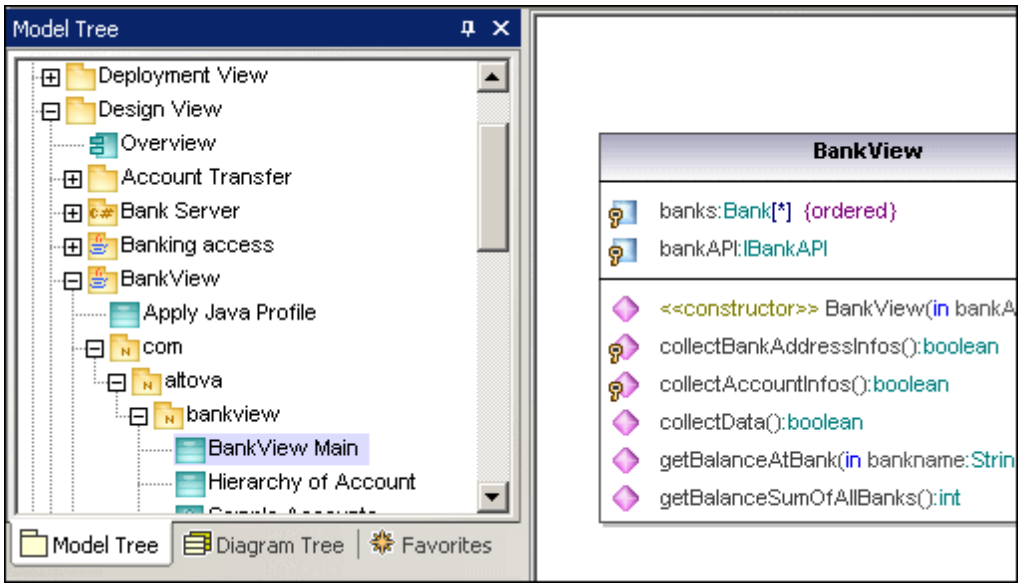


This concludes the **definition** of the stereotype for the moment. We can now use/assign the stereotype when adding an attribute to a class which is part of the BankView package.

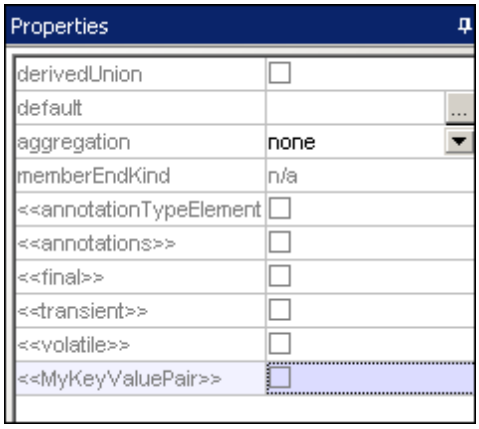
Using / assigning stereotypes

1. Double click the **BankView Main** class diagram icon in the Model Tree.

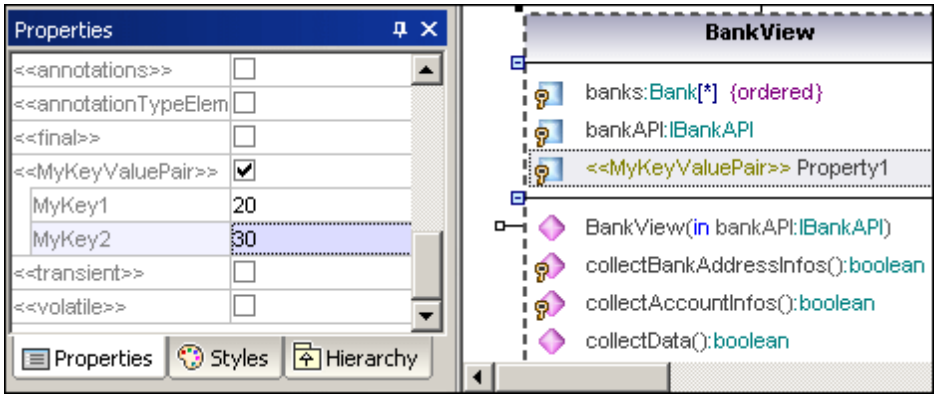


This opens the class diagram and displays the associations between the various classes. We now want to add an attribute to the BankView class, and assign/use the previously defined stereotype.

2. Click the **BankView** class and press F7 to add an attribute.
3. Use the scrollbar of the Properties tab to scroll to the bottom of the list. Notice that the **MyKeyValuePair** stereotype is available in the list box.

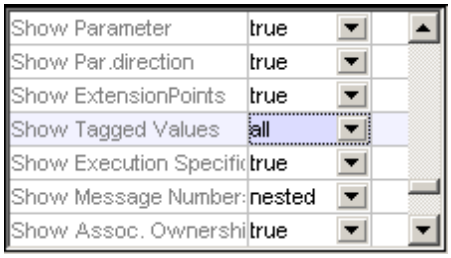


4. Click the **MyKeyValuePair** check box to activate/apply it. The two tagged values MyKey1 and MyKey2, are now shown under the Stereotype entry.
5. Double click in the respective fields and enter some values.



Displaying tagged values in a diagram

1. Click the Styles tab, scroll down to the **Show Tagged Values** entry and select **all**.



The diagram tab now displays the tagged values in the Note element. Double clicking a value in the note element allows you to edit it directly.

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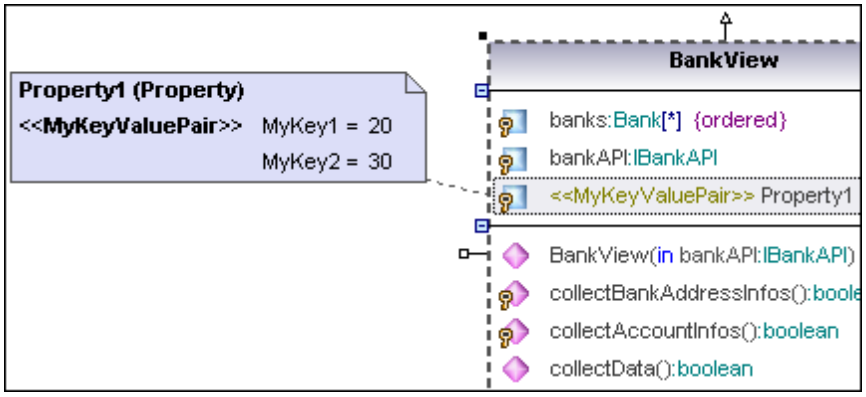
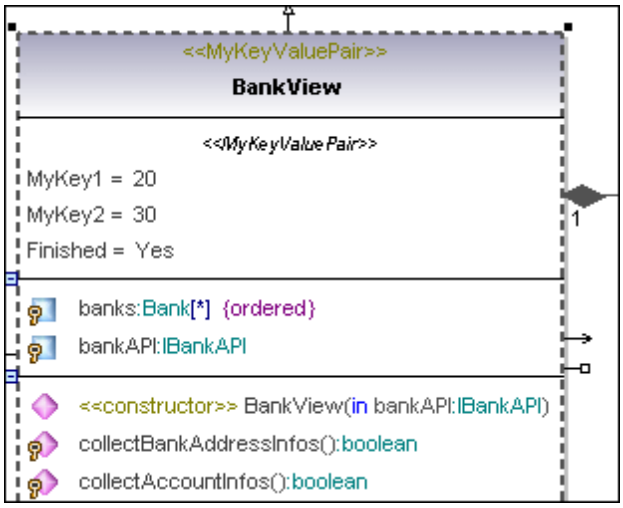


Show tagged Values: **in compartment**



Displays the tagged values in a separate class **compartment**.

Please note:

When hiding attributes or operations using the "Show / Hide node content" context menu option, tagged values are also shown/hidden together with the modeling element.

Association (member) ends can display stereotypes by setting the **Show MemberEnd stereotypes** option to "true" in the Styles tab.

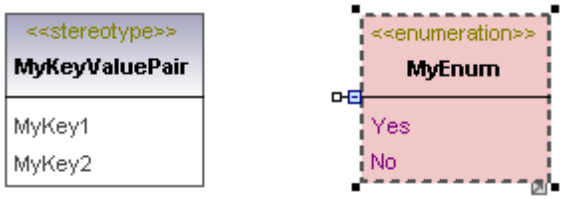
For more information on displaying tagged values see Displaying tagged values.

Stereotypes and enumerations

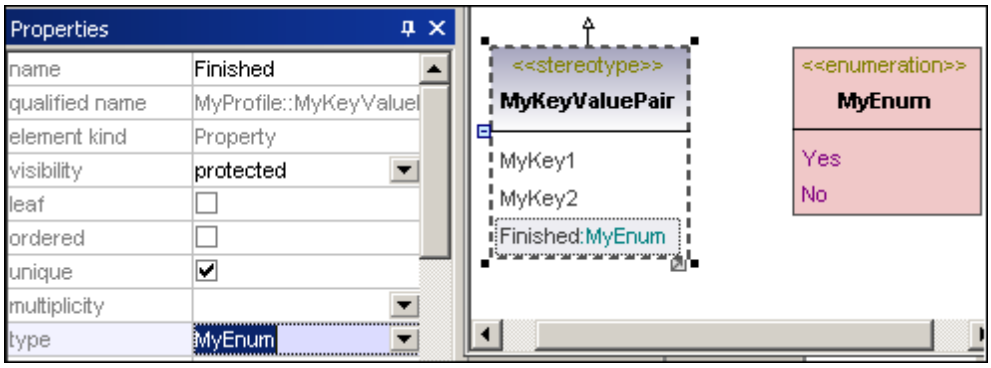
UModel has an efficient method of selecting enumerated values of stereotypes.

Click the diagram tab containing the stereotype definition (i.e. the previously added Profile diagram):

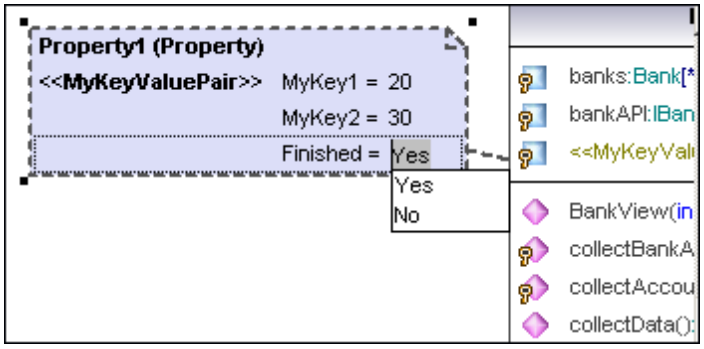
1. Click the Enumeration icon in the icon bar to insert an enumeration into the diagram (containing the previously defined stereotype e.g. ProfileDiagram1).
2. Add **EnumerationLiterals** to the enumeration by pressing SHIFT+F7, or use the context menu, e.g. the EnumerationLiterals - **Yes**, and **No**.



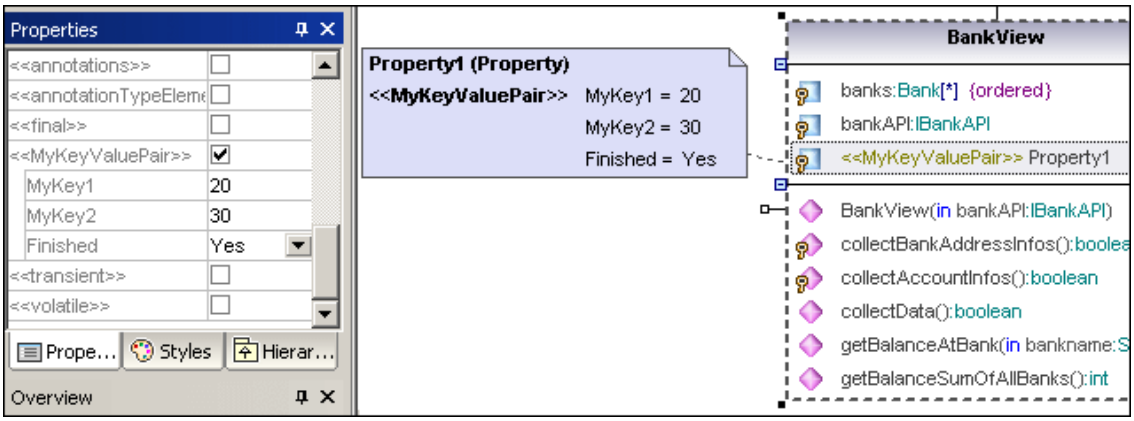
3. Click the stereotype "class" and press F7 to add a new attribute/property, e.g. **Finished**.
4. Select the "**MyEnum**" type from the Properties tab.



5. Switch back to the **BankView Main** class diagram.
6. The Property Finished, is now shown as a tagged value in the note element.



Double clicking the Finished tagged value, presents the predefined enumeration values in a popup. Click one of the enumerations to select it.



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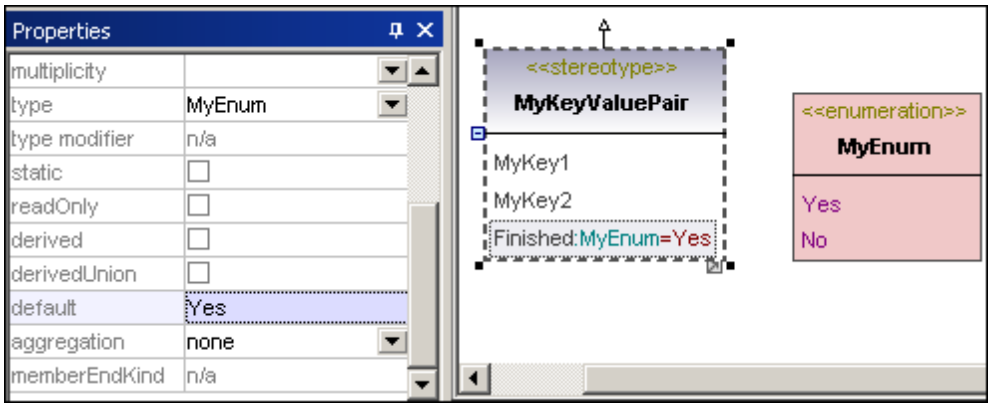
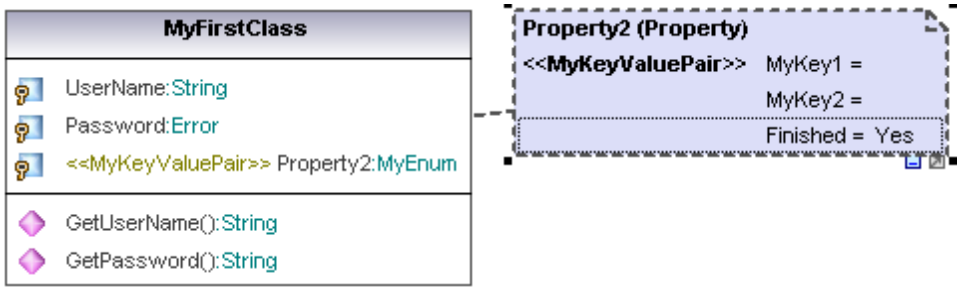
Enumeration default values

UModel allows you to define **default** tagged values. When adding an attribute to the stereotype, double click in the default field and enter one of the existing enumerations as the default value.



In this case, the default value "Yes" is entered.
When a property is added to a class, and the MyEnum type is selected, the default value is automatically inserted as the tagged value i.e. Finished = Yes.

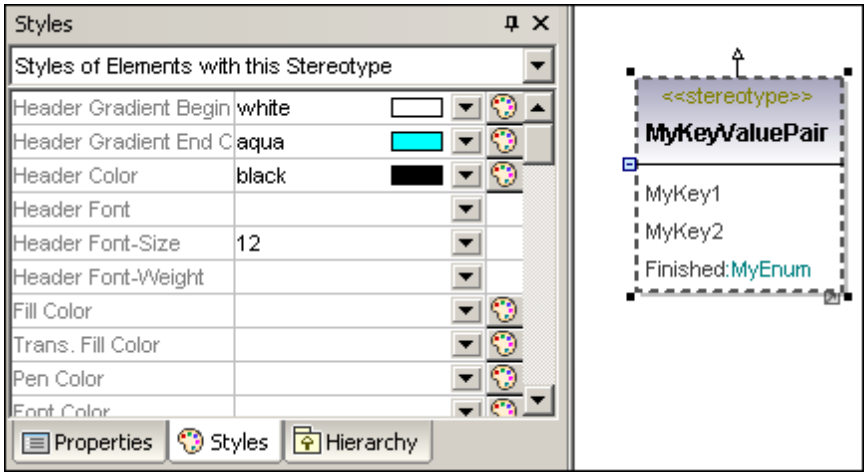


User-defined stereotype styles

It is now possible to create user-defined styles for individual stereotypes. This means that you can have specific fonts, colors etc. that are applied to those classes which are of that type of stereotype.

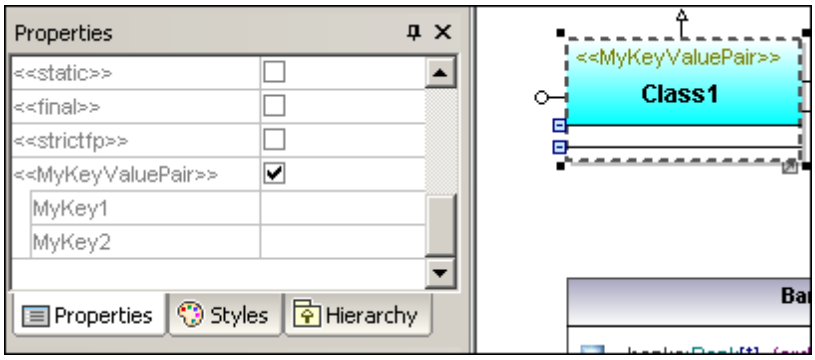
To create user-defined stereotype styles:

1. Click a previously defined stereotype e.g. MyKeyValuePair in the Class diagram.
2. Activate the Styles tab, then select **Styles of elements with this Stereotype** from the combo box.
3. Define the styles of this stereotype using the options in the Styles tab, e.g. Header Gradient End Color = aqua.



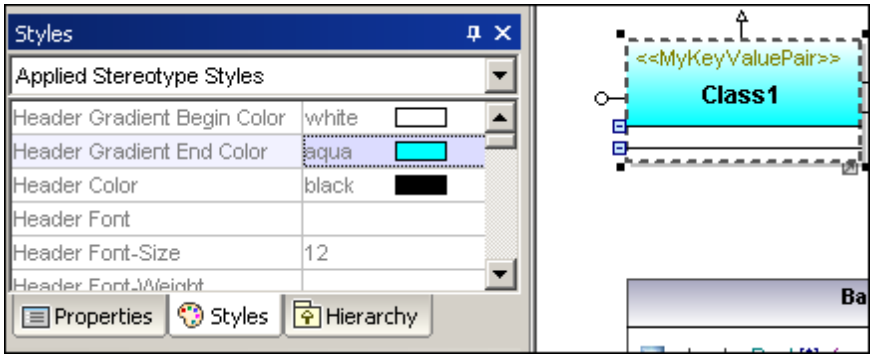
Clicking the stereotype class automatically displays the stereotype styles in the Styles tab.

4. Switch to a different Class Diagram and insert a new class.
5. Click the Class Header/Title and activate the MyKeyValuePair stereotype check box.



The new class now has the styles that were assigned to the stereotype i.e. an aqua gradient. Note that the stereotype styles are **not** applied if the stereotype is applied to an **property** or **operation** within the class.

6. Click the new stereotype class in the diagram then click the Styles tab.
7. Select the "**Appled Stereotype Styles**" entry in the Styles combo box.



You can now preview the style settings defined for this stereotype in the Styles window. Note that you cannot change the style settings here. This must be done in the class diagram in which the stereotype was defined.

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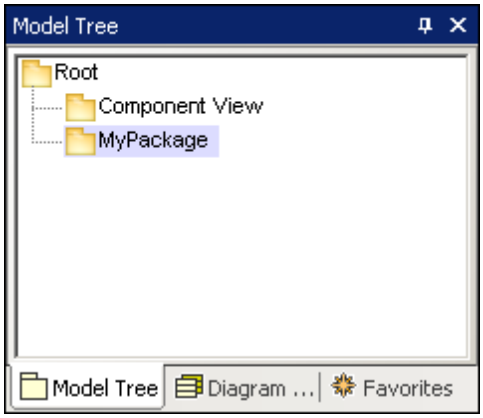
Custom stereotype icons - assigning

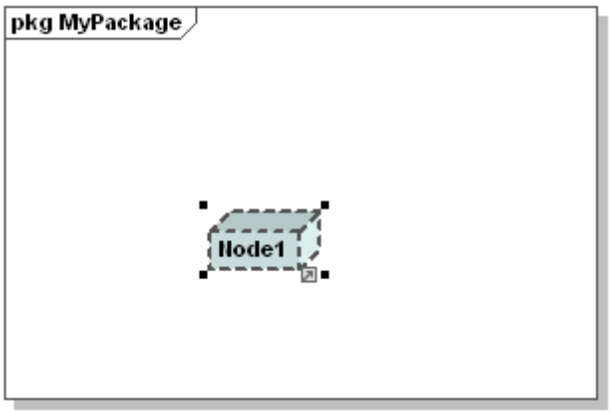
UModel allows you to create custom stereotype icons for custom stereotypes.

To create a custom stereotype icon:

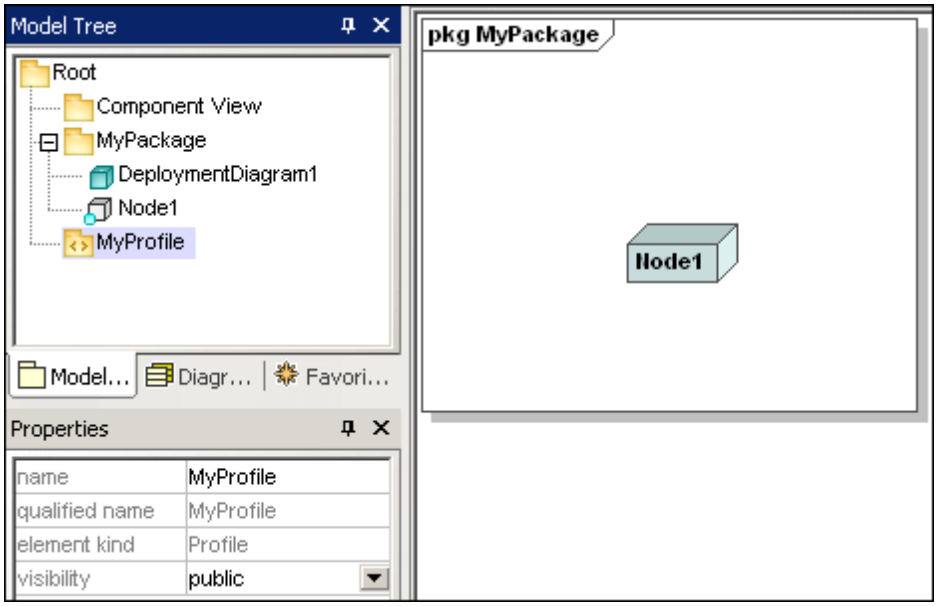
1. Right click the Root package and select New element | Package.
2. Name the package MyPackage.



3. Right click MyPackage and select New Diagram | Deployment diagram.
   This creates a deployment diagram in MyPackage.
4. Right click in MyPackage and select New | Node.



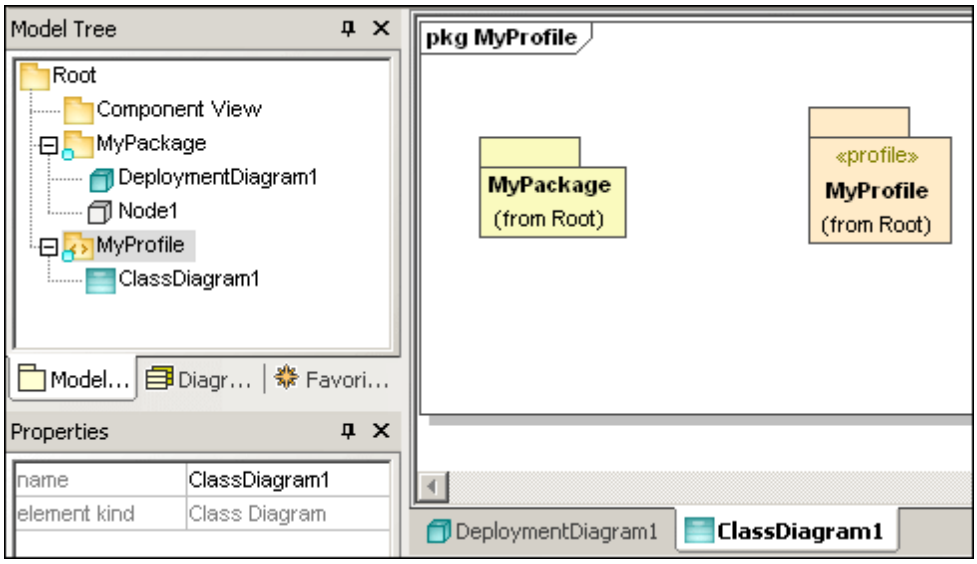
   This adds the node object to the diagram.
5. In the Model Tree, right click the Root package and select New element | Profile.
6. Name the profile "MyProfile".



7. Right click the MyProfile package and select New Diagram | Class diagram.

Selecting the stereotype icon

1. Drag the MyPackage and MyProfile folders from the Model Tree into the Class diagram.



2. Click the Profile-Application icon in the tool bar, and drag the connector from MyPackage to MyProfile.

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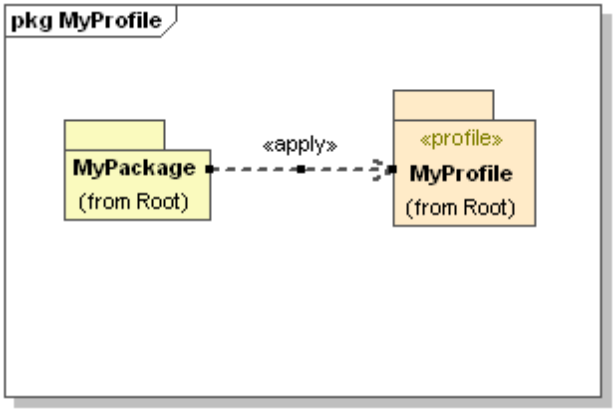
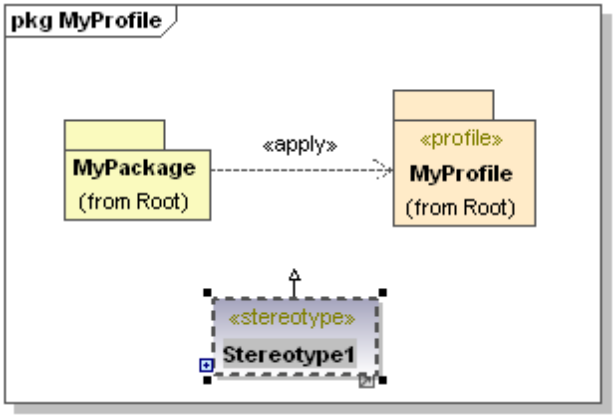
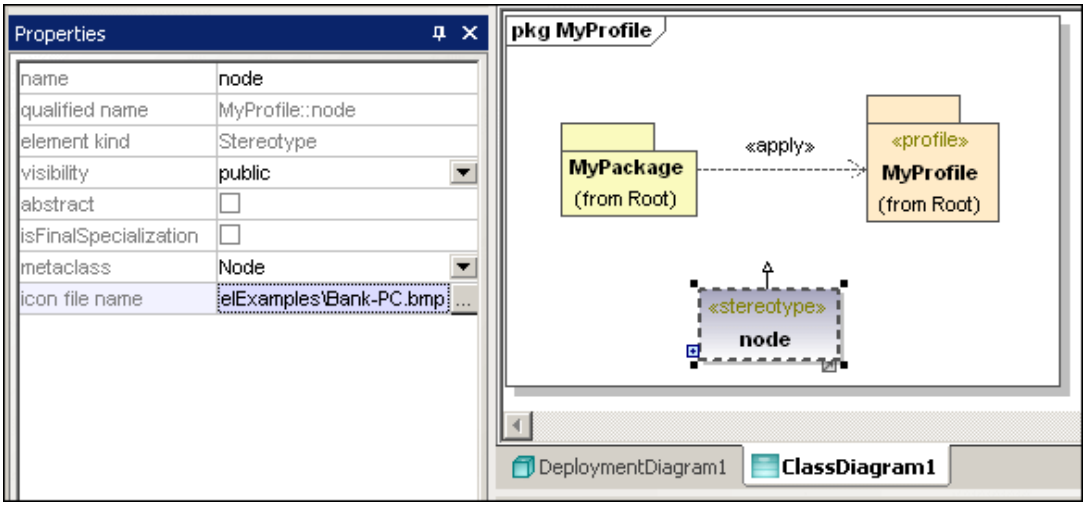


3. Click the stereotype icon in the toolbar and click in the MyProfile package to insert it.

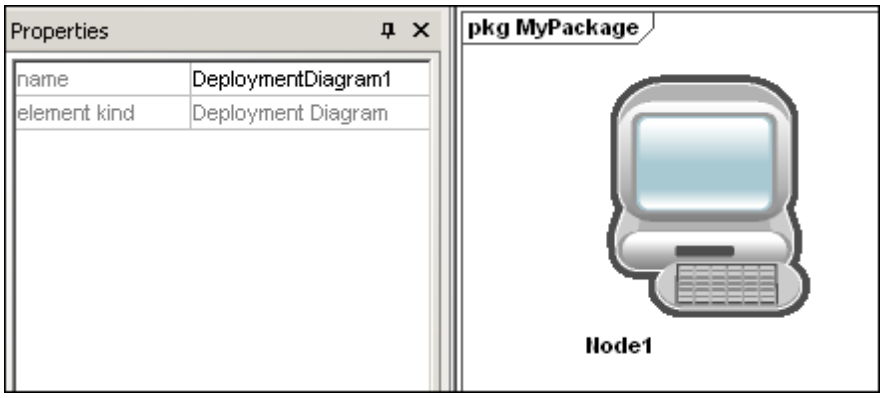


While the stereotype element is active, make the following changes in the Properties tab:

4. Change the name of the element from Stereotype1 to "node".
5. Change the metaclass property value from Element to "Node".
6. Enter a path for the image that you want to use as the stereotype icon in the "icon file name" field, or click the Browse button to select a path, e.g. c:\Documents and Settings \Me\My Documents\Altova\UModel2011\UModelExamples\Bank-PC.bmp.



7. Switch back to the Deployment diagram by clicking the DeploymentDiagram1 tab.
8. Click the Node1 element in the diagram.
9. Using the Properties window, activate <node> checkbox.



The representation of the stereotype icon has now changed to that of the selected bitmap.

Please note:

When displaying the custom icons the RGB color 82,82,82 is the backgrougd transparent color.

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9.3 Additional Diagrams

UModel now supports the import and generation of W3C XML Schemas as well as their forward and reverse-engineering in the code-engineering process.

XML Schema

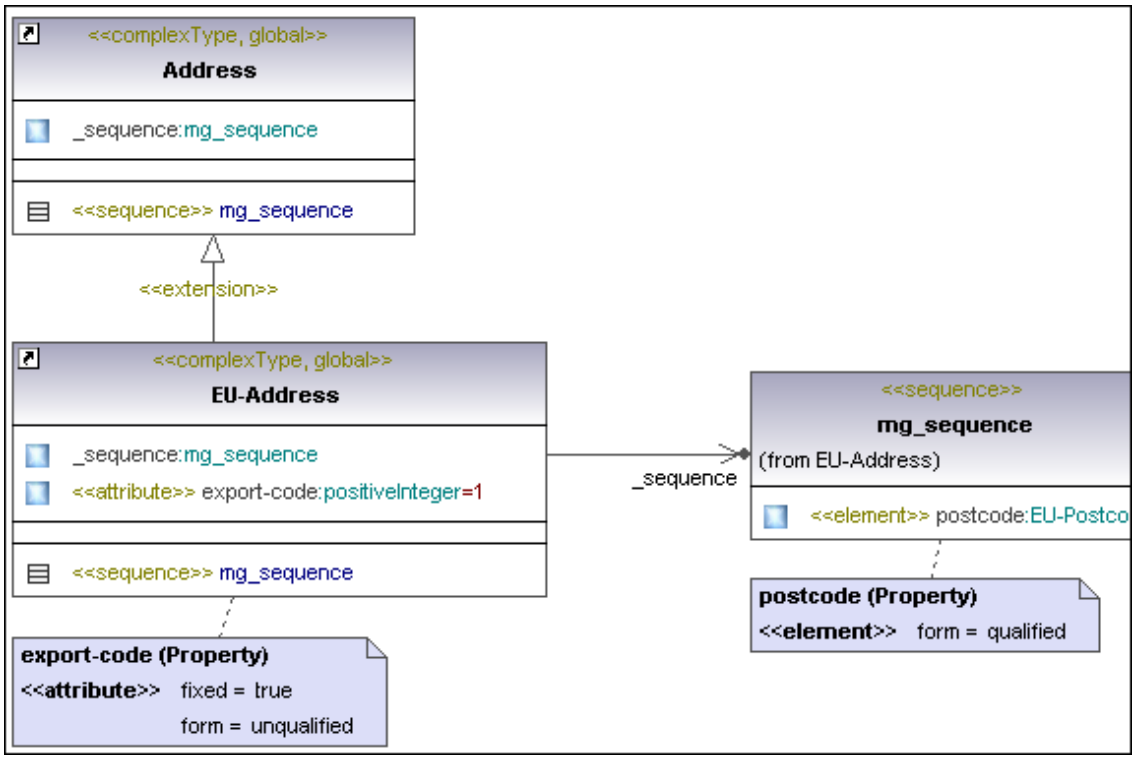
9.3.1 XML Schema Diagrams

Altova web site: XML Schemas in UML

XML Schema diagrams display schema components in UML notation. Global elements i.e. elements, simpleTypes, complexTypes are shown as classes, or datatypes, with attributes in the attributes compartment.

There are no operations in the Operation compartment. The Tagged Value note modeling element is used to display the schema details.

To see how the UML elements and XML schema elements/attributes are mapped, navigate to XML Schema to/from UModel elements.



Please note:

Invalid XML Schemas cannot be imported into UModel. XML Schemas are not validated when importing, or creating them in UModel. XML Schemas are also not taken into account during the project syntax check. A well-formed check is however performed when importing an XML schema.

Importing XML Schema(s)

To import a single XML Schema:

1. Select the menu option **Project | Import XML Schema file**.

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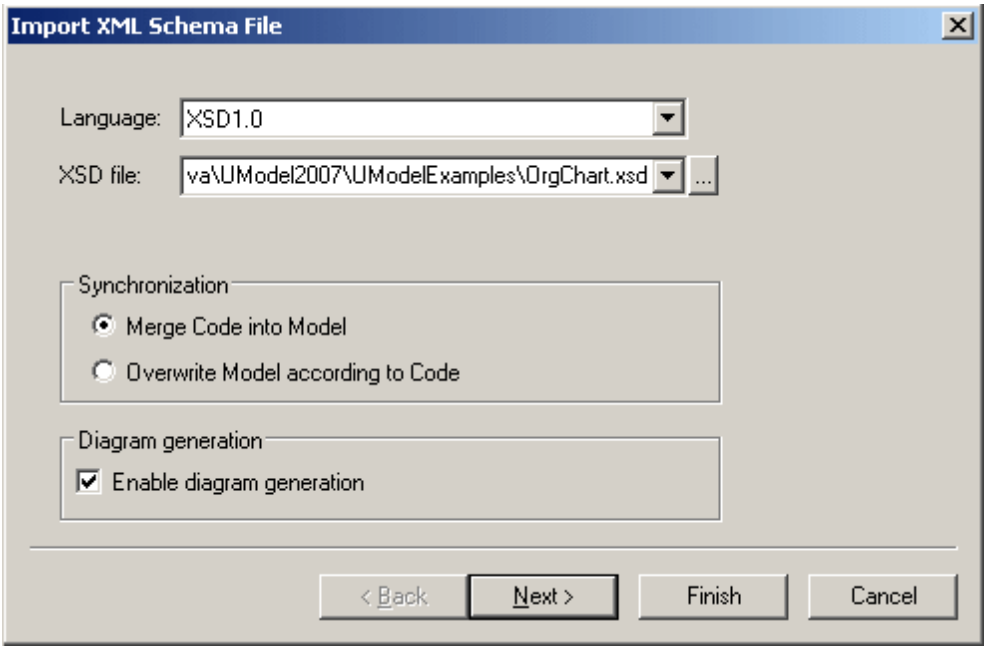
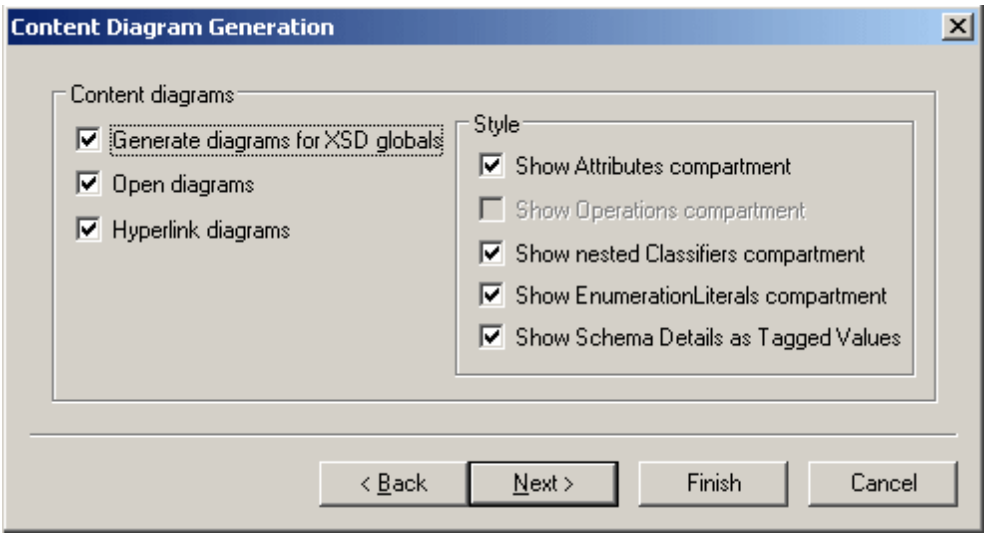
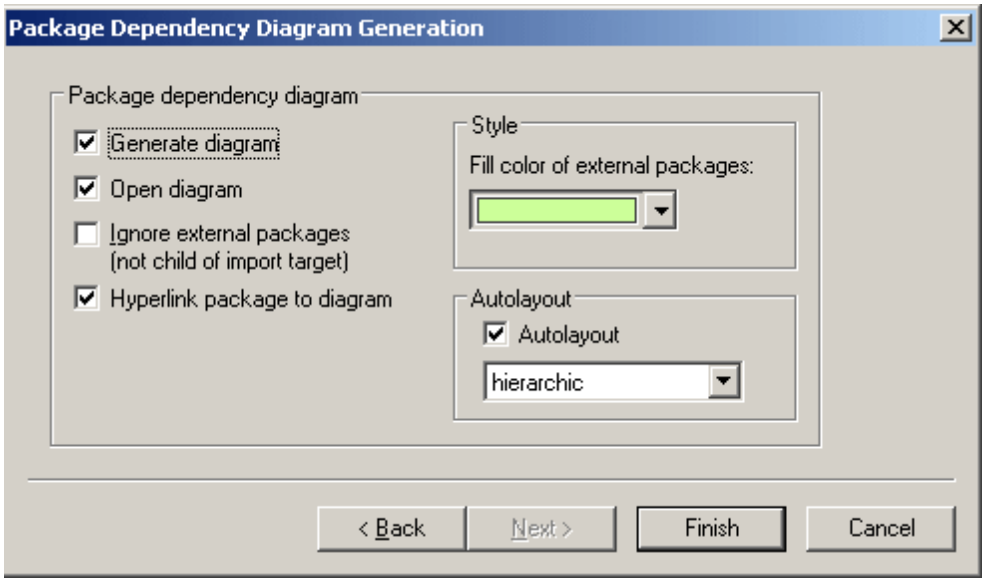


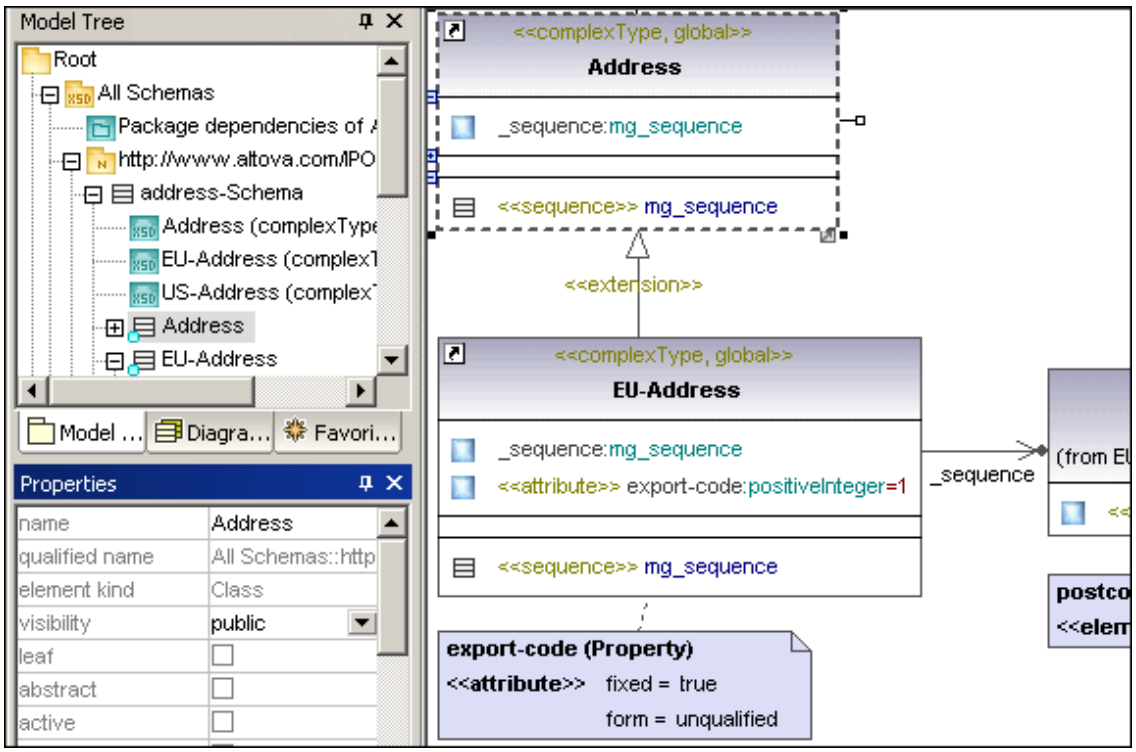
2. Make sure that the **Enable diagram generation** check box is active and click Next, to continue.



3. Define the Content diagram options in the group of that name. The first option creates a separate diagram for each schema global element.
4. Select the compartments that are to appear in the class diagrams in the Style group. The "Show schema details as tagged values" option displays the schema details in the Tagged Value note modeling element.
5. Click Next to define the Package dependency diagram.



6. Click Finish to start the XML Schema import.
   The schema(s) are imported into UModel and all diagrams are available as tabs. The screenshot below shows the content of the EU-Address (complexType) diagram.



Please note:
A new package called All Schemas was created and set as the XSD Namespace Root. All XSD globals generate an XML Schema diagram, with the diagrams under the respective namespace packages.

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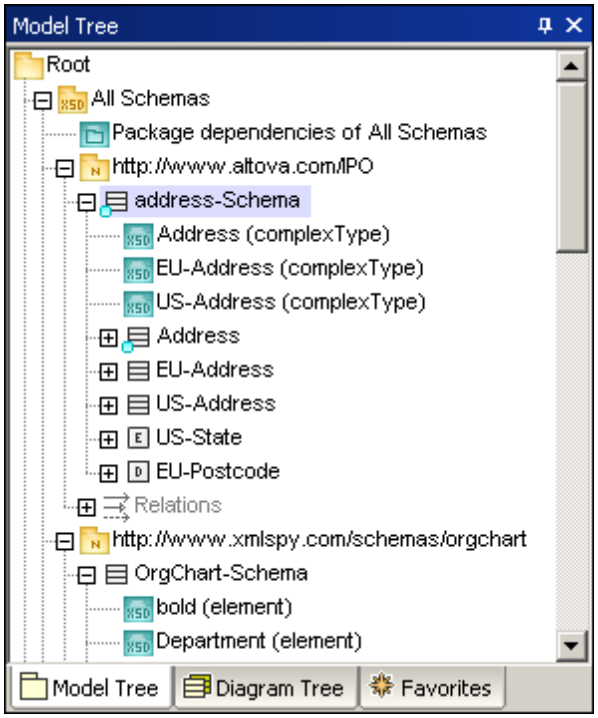
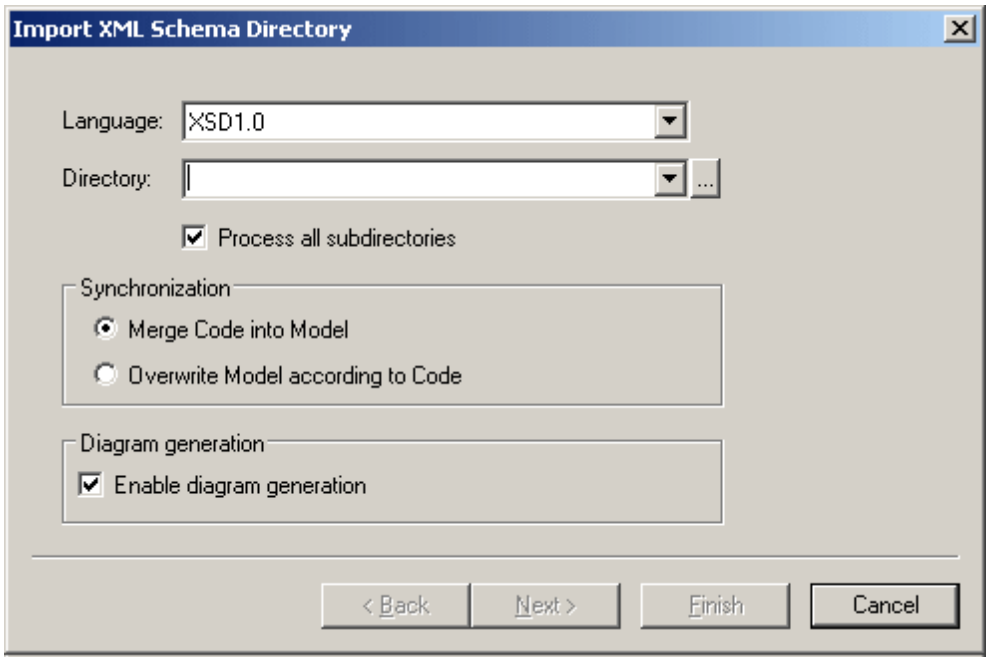


To import multiple XML Schemas:

1. Select the menu option **Project | Import XML Schema directory.**



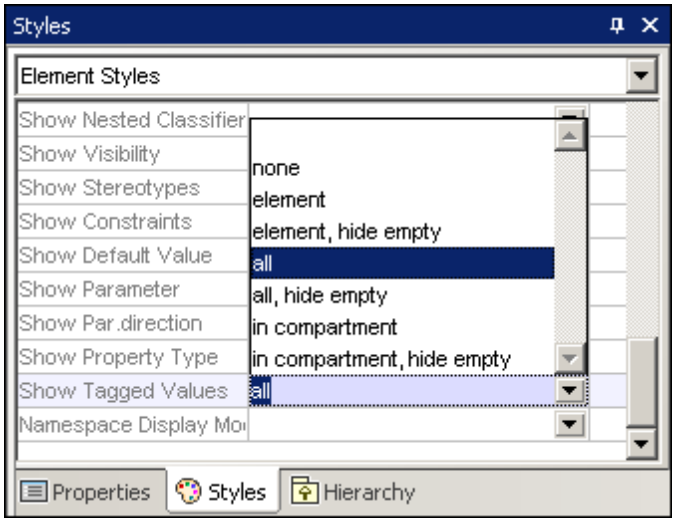
2. Activate the "Process all subdirectories" if you want to import Schemas from all subdirectories.
   The rest of the import process follows the sequence of importing a single XML schema described above.

Please note:

If an XML schema includes or imports other schemas, then these schemas will be automatically imported as well.

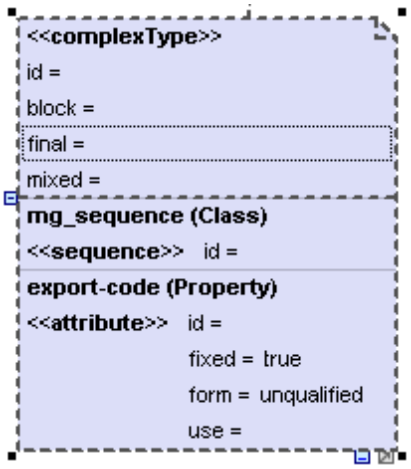
Displaying tagged values - schema details

Schema details displayed as tagged values in the Tagged Value note element, can be configured using the **Show Tagged Values** in the Styles tab, or by clicking the "Toggle compact mode" icon at the bottom right of the Tagged Value **note**. This switches between the two states "all" and "all, hide empty", etc. which are shown below.



Note:
Selecting the tagged values from the **Styles** tab sets the the tagged value settings project wide. Right clicking a **class** and selecting Tagged values | all etc., only affects the individually marked classes.

Show tagged values: **all**
Displays the tagged values of the class as well as those of the owned attributes, operations etc.



Show tagged values: **all, hide empty**
Displays only those tagged values where a value exists e.g. fixed=true.

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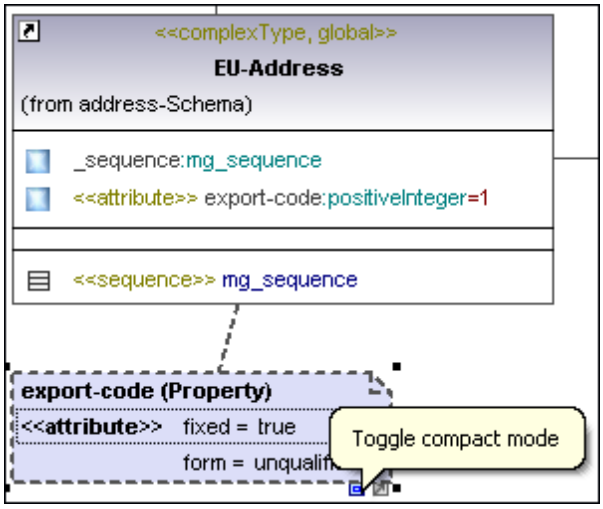
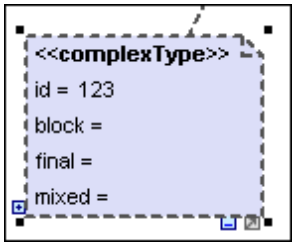
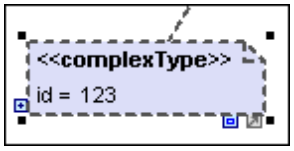


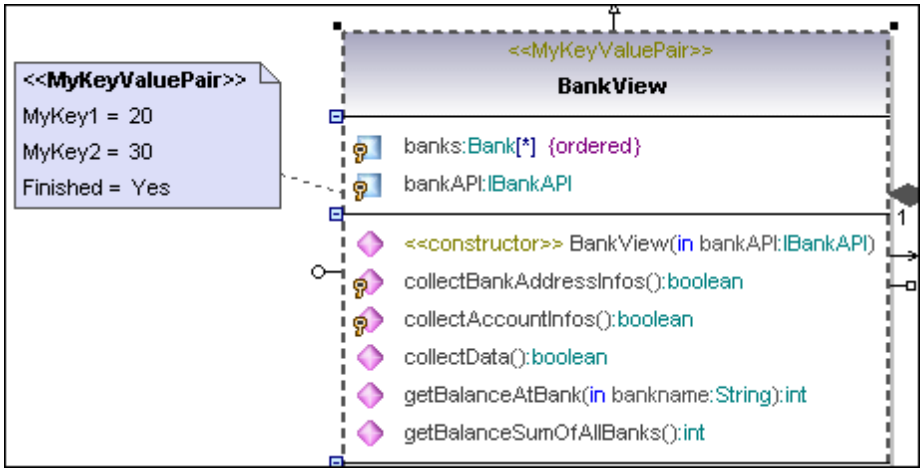
Show tagged values: **element**
Displays the tagged values of the class but **not** those of the owned attributes, operations etc.



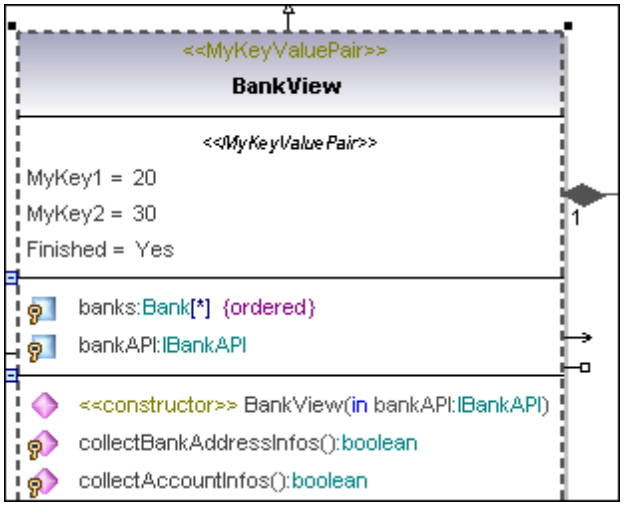
Show tagged values: **element, hide empty**
Displays only those tagged element values of a class, without the owned attributes, where a value exists e.g. id=123



Show tagged values: **in compartment**



Displays the tagged values in a separate class compartment.



Show tagged values: **in compartment, hide empty**
Displays only those tagged element values of a class, without the owned attributes, where a value exists.

XML Schema annotation:
When importing XML schemas, please note that only the first annotation of a complex- or simpleType is displayed in the Documentation window.

Inserting XML Schema elements

Using the toolbar icons:

1. Click the specific XML Schema diagram icon in the toolbar.
2. Click in the XML Schema diagram to insert the element.
   Note that holding down CTRL and clicking in the diagram tab, allows you to insert multiple elements of the type you selected.

Dragging existing elements into the XML Schema diagram:
Elements occurring in other diagrams can be inserted into an existing XML Schema diagram.

1. Locate the element you want to insert in the Model Tree tab (you can use the search function text box, or press CTRL+F, to search for any element).
2. Drag the element(s) into the XML Schema diagram.

   Note: you can also use the Copy and "Paste in diagram only" commands to insert elements.

Please note:
Either method described above, applies to any of the XML Schema elements that can be inserted onto the diagram.

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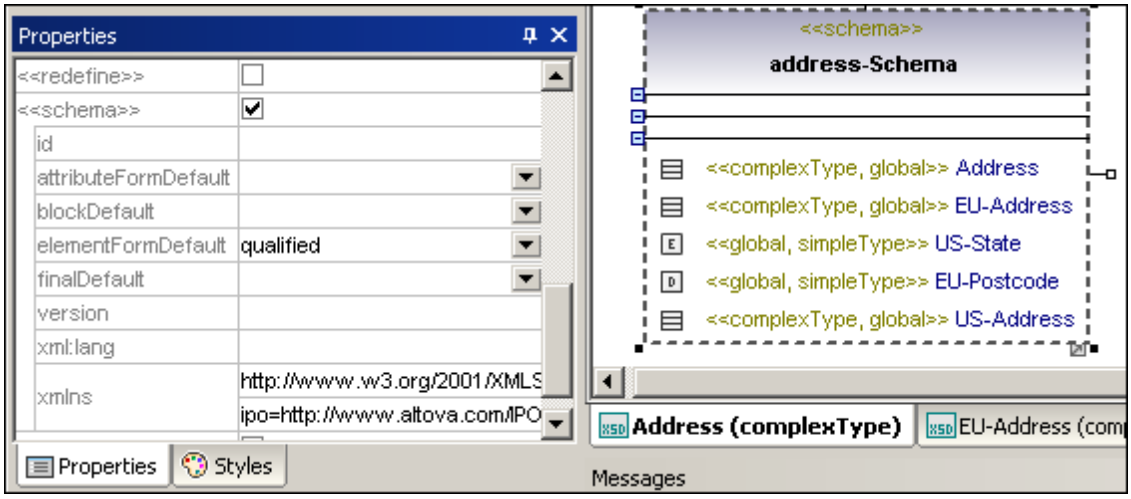
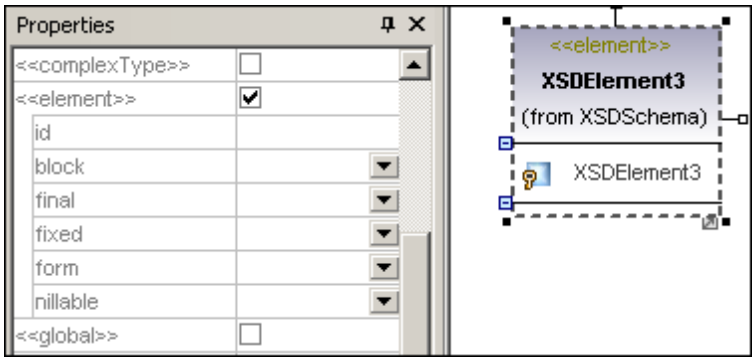
XSD Target Namespace
Inserts/defines the target namespace for the schema. The XSD Target Namespace must belong to an XSD Namespace Root package.

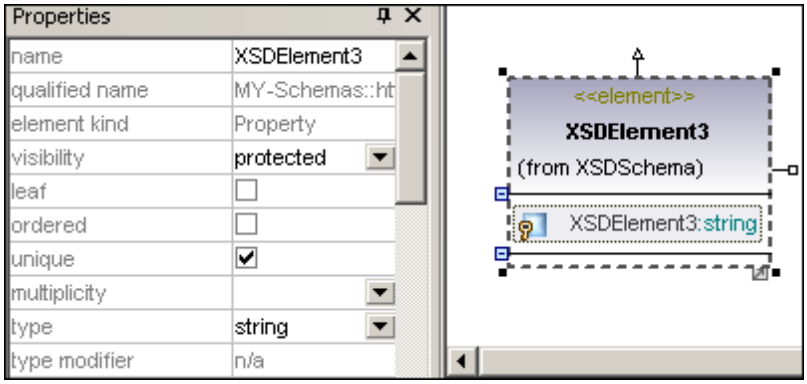
XSD Schema
Inserts/defines an XML schema. The XSD schema must belong to an XSD Target Namespace package.



Element (global)
Inserts a global element into the diagram. Note that a property is also automatically generated in the attributes compartment.



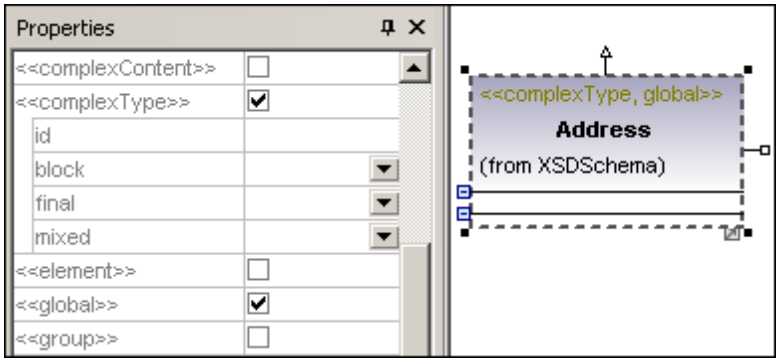
To define the property datatype:
1. Double click the property and place the cursor at the end of the line.
2. Enter a colon character ":", and select the datatype from the popup dialog box, e.g string.



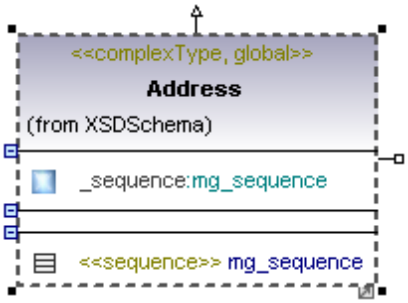
Creating a "content model" consisting of a complexType with mandatory elements:

This will entail inserting a complexType element, a sequence element/compositor, and three elements.

1. Click the XSD ComplexType icon , then click in the diagram to insert it.
2. Double click the name and change it to Address.



3. Right click Address and select **New | XSD Sequence**.



4. Click the **_sequence:mg_sequence** attribute in the attribute compartment, and drag it out into the diagram.

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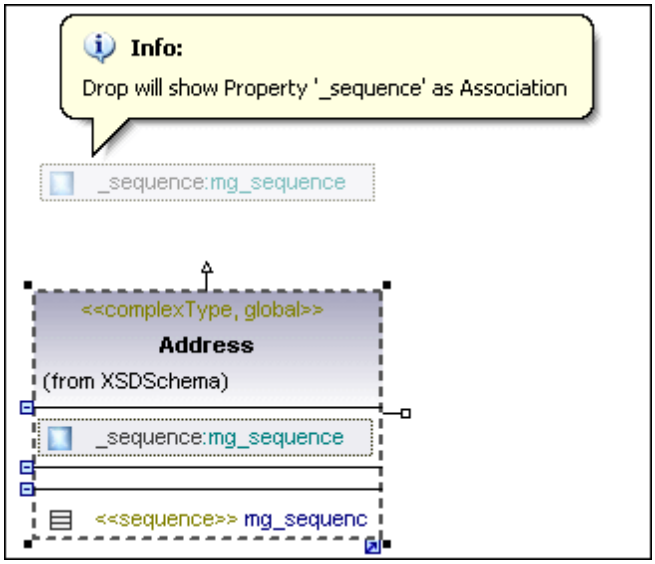
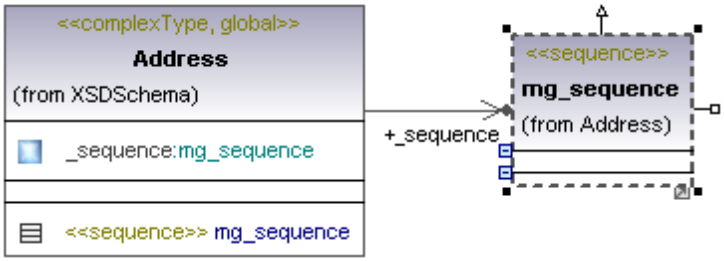
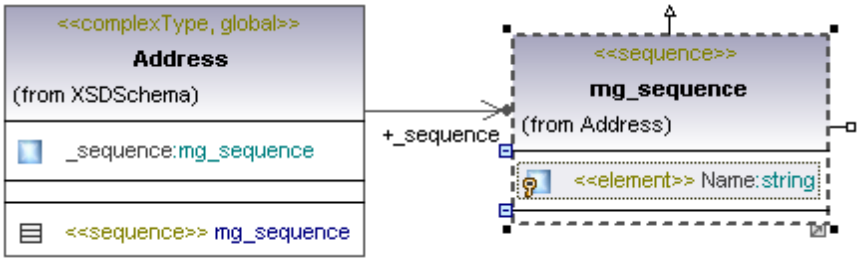


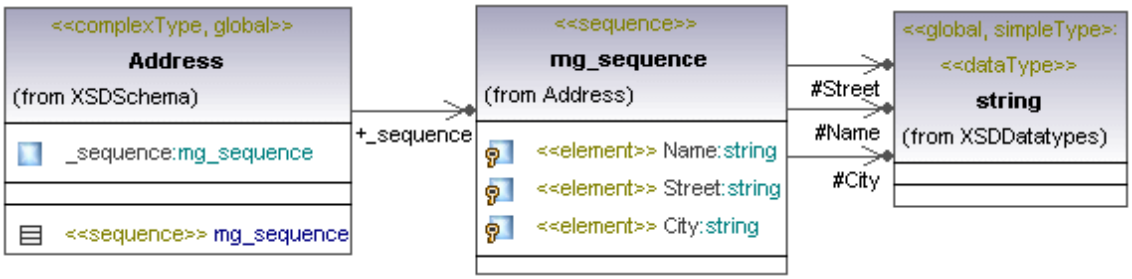
This creates a sequence class/compositor at the drop position.



5. Right click the sequence class and select **New | XSD Element (local)**.
   This adds a new property element.
6. Double click the property, enter the element name, e.g. Name, add a colon ":" and enter "string" as the datatype.



7. Do the same for the two more elements naming them Street and City for example.
8. Click the Name property and drag it into the diagram.

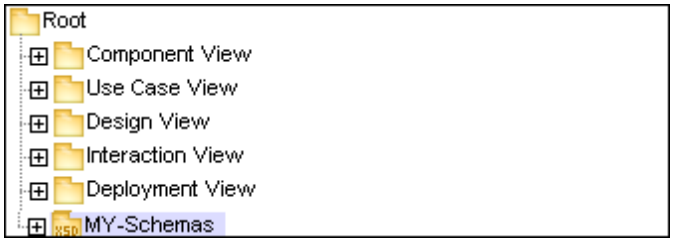


Creating and generating an XML Schema

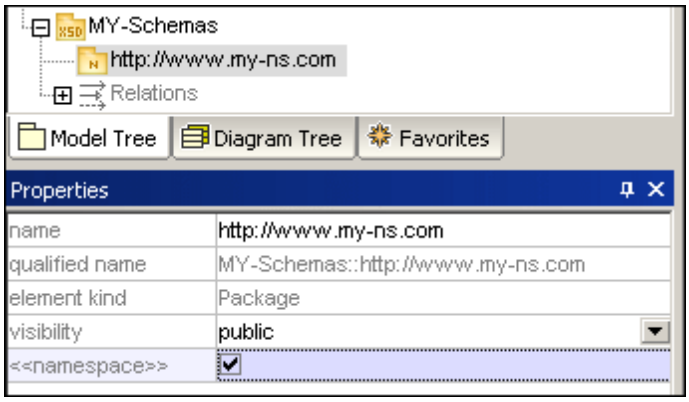
You would generally import a schema, edit it in UModel, and output the changes. It is however possible to generate a schema from scratch. This will only be described in broad detail however.

Creating a new schema in UModel:

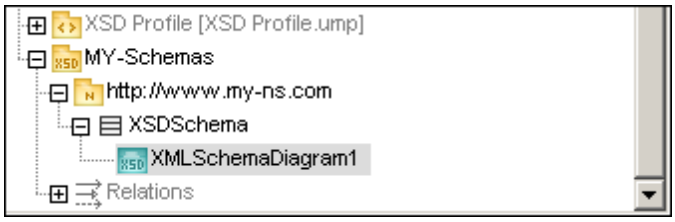
1. Create a new package in the Model Tree e.g. MY-Schemas.



2. Right click the new package and select the menu option **Code Engineering | Set as XSD namespace root**.
   You are asked if you want to assign the XSD profile if this is the first XSD Namespace root in the project.
3. Click OK to assign the profile.
4. Right click the new package and select **New Element | Package**.
5. Double click in the package name field and change it to the namespace you want to use, e.g. http://www.my-ns.com.
6. Click the <<namespace>> check box in the Properties tab, to define this as the target namespace.



7. Right click the namespace package and select **New diagram | XML Schema diagram**.
   You will be prompted if you want to add the Schema diagram to a new XSD Schema.
8. Click Yes to add the new diagram.



You can now create your schema using the icons in the XML Schema icon bar.

Generating the XML schema:

1. Drag the XSDSchema onto a component to create a Component Realization.

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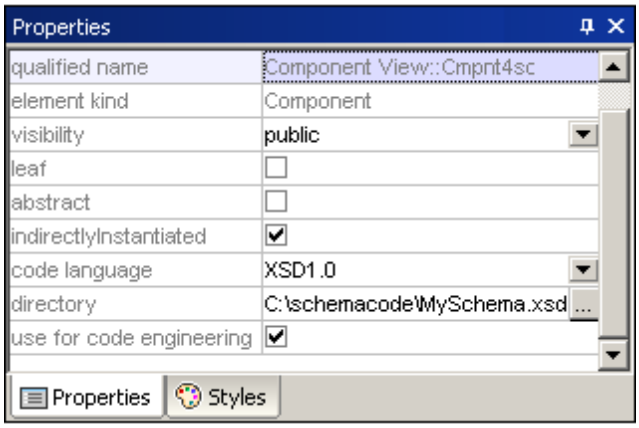
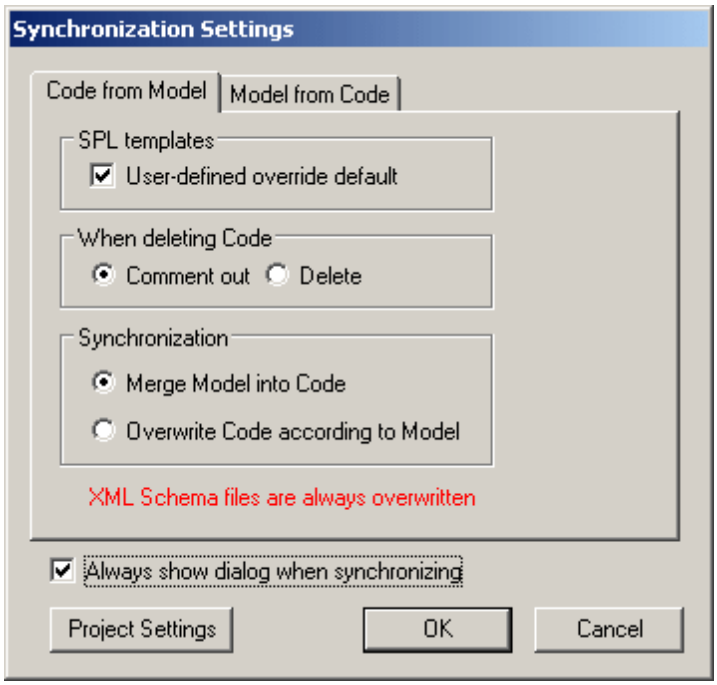
2. Make sure that you set the code language, of the component, to XSD1.0, and enter a path for the generated schema to be placed in, e.g. C:\schemacode\MySchema.xsd.



3. Select the menu option **Project | Overwrite Program Code from UModel project,** and click OK to generate the schema.



Chapter 10

XMI - XML Metadata Interchange

10 XMI - XML Metadata Interchange

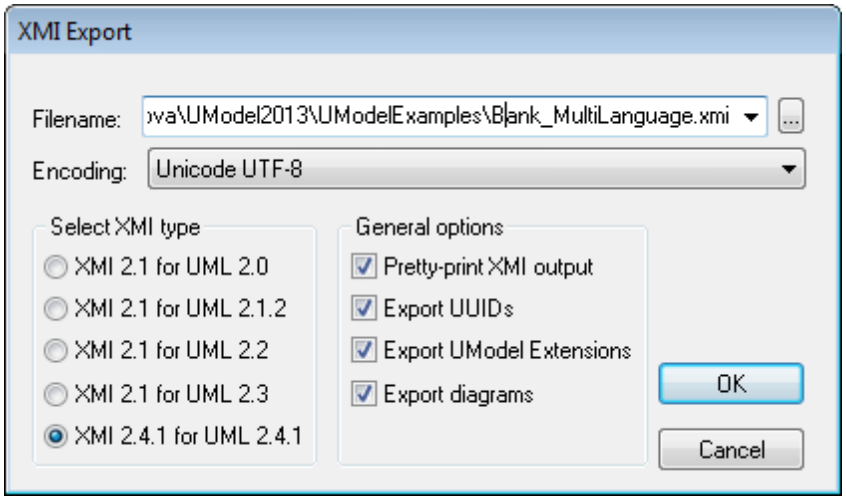
Altova web site: Exchanging UModel projects using XMI

UModel supports the export and import of XMI 2.4 for UML 2.0 / 2.1 / 2.1.1 and 2.1.2, 2.2, 2.3, 2.4. Do not use the Export to XMI function to archive your UModel projects, please archive the *.**ump** project files instead.

Select the menu item **File | Export to XMI File** to generate an XMI file from the UModel project, and File | Import from XMI File, to import a previously generated XMI file.

The XMI Export dialog box allows you to select the specific XMI format you want to output, XMI for UML 2.0/2.1.1. During the export process included files, even those defined as "include by reference" are also exported.

Please note:
If you intend to **reimport** generated XMI code into UModel, please make sure that you activate the "Export UModel Extensions" check box.



Pretty-print XMI output

This option outputs the XMI file with XML appropriate tag indentation and carriage returns/line feeds.

Export UUIDs

XMI defines three versions of element identification: IDs, UUIDs and labels.

- IDs are unique within the XMI document, and are supported by most UML tools. UModel exports these type of IDs by default, i.e. none of the check boxes need activated.
- UUID are Universally Unique Identifiers, and provide a mechanism to assign each element a global unique identification, GUID. These IDs are globally unique, i.e. they are not restricted to the specific XMI document. UUIDs are generated by selecting the "Export UUIDs" checkbox.
- UUIDs are stored in the standard canonical UUID/GUID format (e.g "6B29FC40-CA47-1067-B31D-00DD010662DA", "550e8400-e29b-41d4-a716-446655440000",...)
- Labels are not supported by UModel.

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Please note:
The XMI import process automatically supports both types of IDs.

Export UModel Extensions

XMI defines an "extension mechanism" which allows each application to export its tool-specific extensions to the UML specification. Other UML tools will, however, only be able to import the standard UML data (ignoring the UModel extensions). This UModel extension data will be available when importing into UModel.

Data such as the file names of classes, or element colors, are not part of the UML specification and thus have to be deleted in XMI, or be saved in "Extensions". If they have been exported as extensions and re-imported, all file names and colors will be imported as defined. If extensions are not used for the export process, then these UModel-specific data will be lost.

When importing an XMI document, the format is automatically detected and the model generated.

Export diagrams

Exports UModel diagrams as "Extensions" in the XMI file. The option "Export UModel Extensions" must be active to be able to save the diagrams as extensions.

Chapter 11

Teamwork support for UModel projects

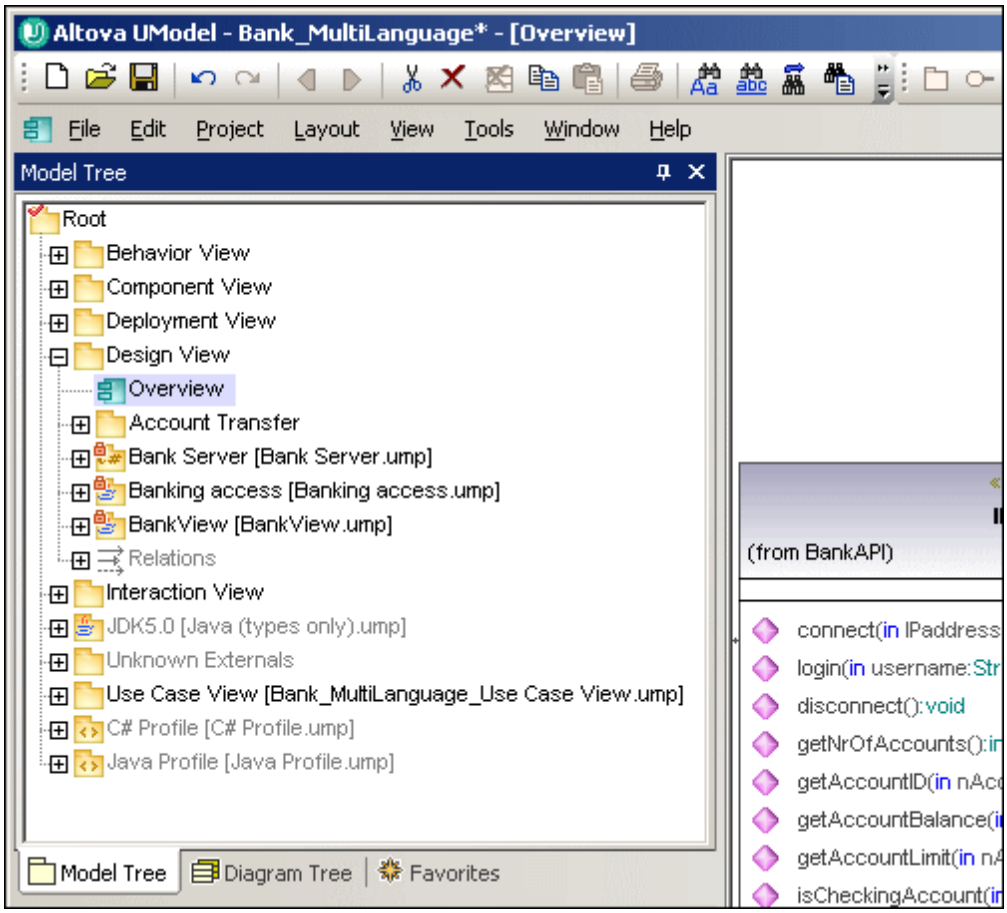
11 Teamwork support for UModel projects

UModel projects can be split up into multiple subprojects allowing several developers to simultaneously edit different parts of a single project. Each individual subproject can be added to a source control system.

The top-level project i.e. the project from which the subprojects can be included, is called the **main** project. Subprojects are created on the package level as individual UModel project files and have a *.ump extension.

Subprojects can be created/included in two different ways:

- As **editable** from within the **main** project, and at the subproject level
- As read-only from within the main project, i.e. only editable at the subproject level.



Subprojects can be structured in any way that you wish, in a flat or hierarchical structure, or a combination of both. This makes it theoretically possible to split off every package of a main project, into read-only/editable subproject files.

During the code-engineering process all subordinate components of a subproject are considered, there is no difference between a single project file or one that consists of multiple editable subprojects.

This also applies to UML diagrams, they can also be edited at the main, or subproject, level.

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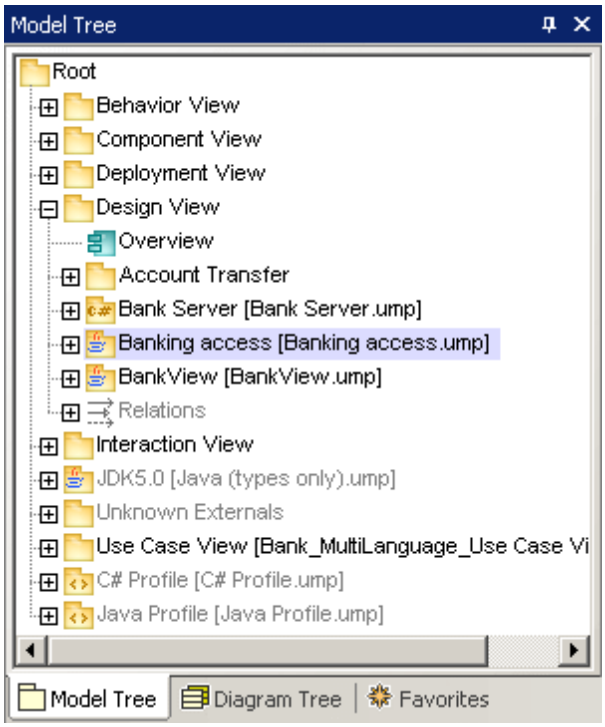
11.1 Creating and editing subproject files

The example discussed here shows how the **Bank_MultiLanguage.ump** project was split up into multiple subprojects.

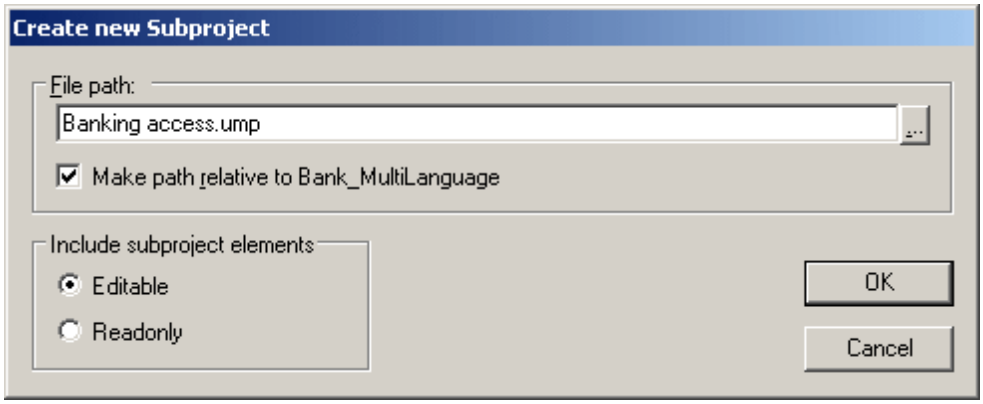


Please note:
UModel allows you to share packages and UML diagrams they might contain, between different projects. Packages can be included in other projects by reference, or as a copy. Please see Sharing Packages and Diagrams for more information.

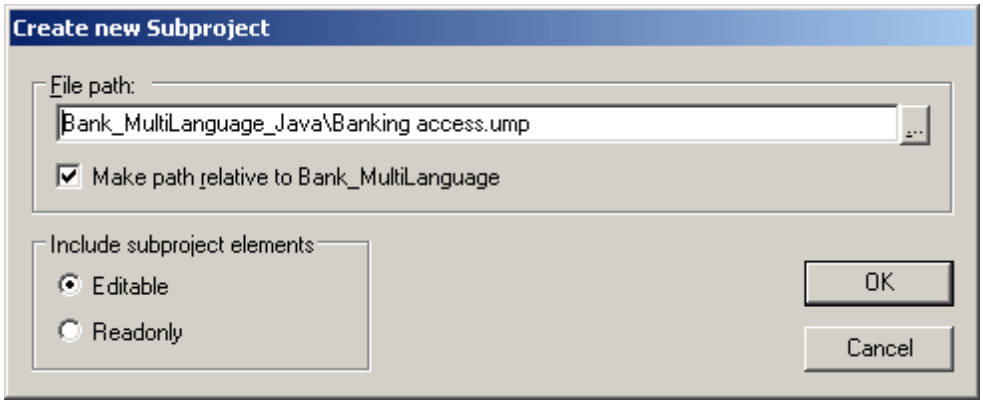
To create a subproject file

Subproject files can be split off a main, or subproject, file at any time.

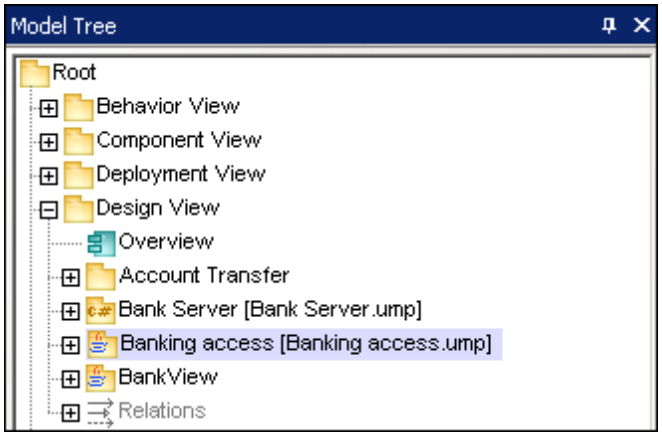
1. Right click a package(s) e.g. **Banking access** and select **Subproject | Create new Subproject**.



2. Click the Browse button and select the subdirectory **\Bank_MultiLanguage_Java**.

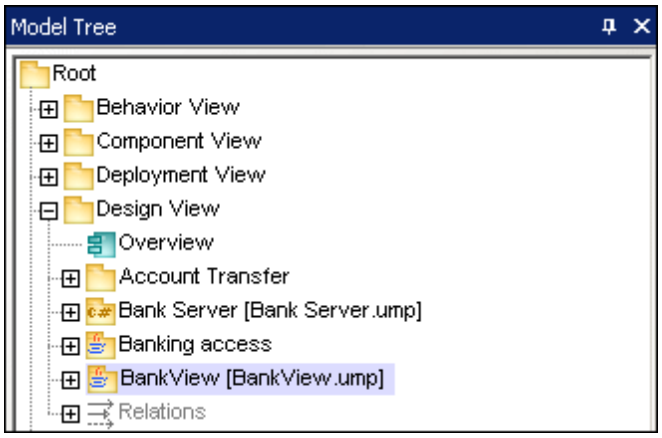


3. Select "Editable" to be able to edit the subproject from the main project. (Selecting Read-only makes it uneditable in the main project.) Then click OK.



The name of the subproject file is shown in square brackets next to the package name and the file **Banking access.ump** file is placed in the **UModelExamples \Bank_MultiLanguage_Java** folder.

The same method is used to create a subproject of the BankView folder. The **BankView.ump** file is placed in the **...\UModelExamples\Bank_MultiLanguage_Java** folder.



Please note:

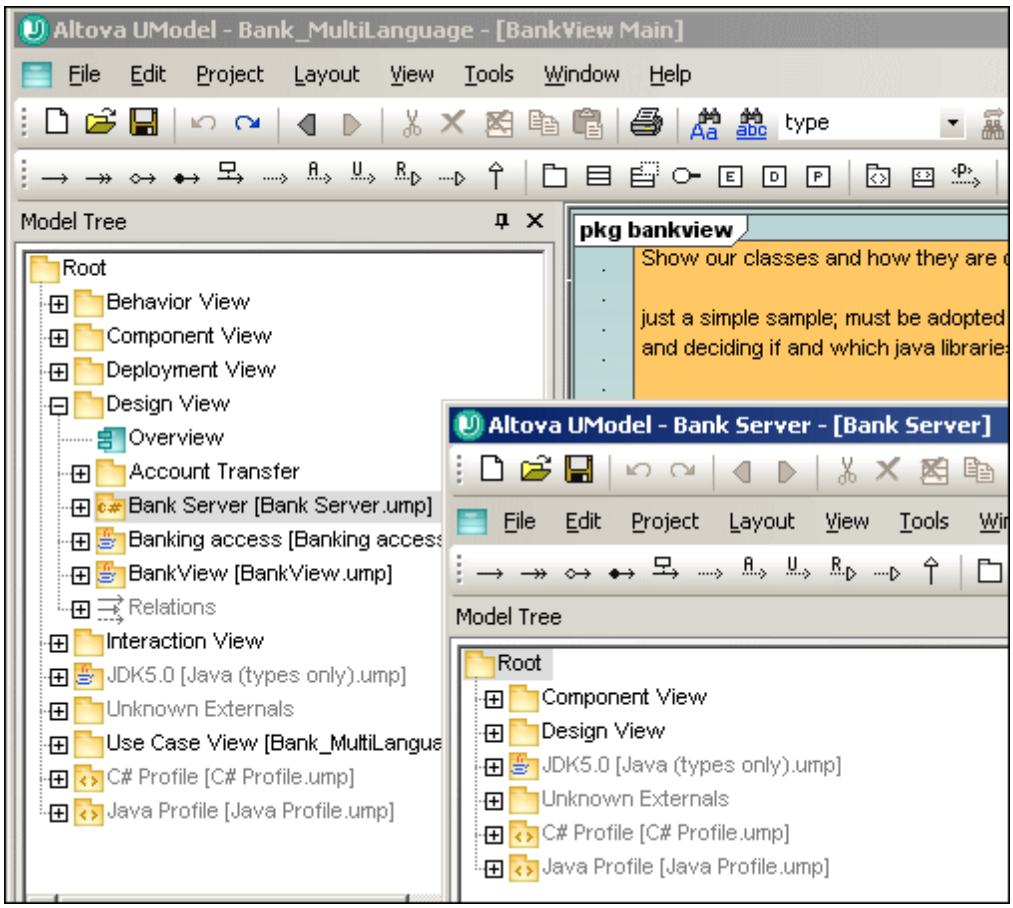
The file path of the subproject can be changed at any time by right clicking the subproject

and selecting **Subproject | Edit File Path**.

Opening and editing subproject files

Having created a subproject file, the resulting *.ump file can then be opened, and edited, as a "main" UModel project file. For this to be successful there should not be any unresolved references to other elements. UModel automatically performs checks when creating a subproject from the "main" project, and whenever a file is saved.

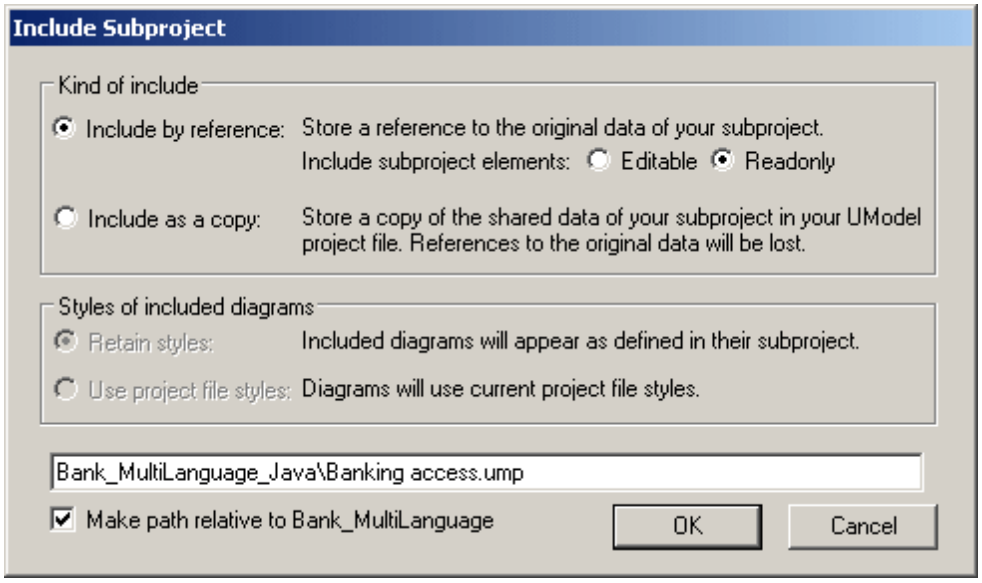
1. Right click the subproject package (e.g. Bank Server.ump) in the main project and select **Project | Open as Project**.
   This starts another instance of UModel and opens the subproject as a "main" project. Any unresolved references are shown in the Messages window.



Reusing subprojects

Subprojects that have been split off from a main project can be used in any other main project(s).

1. Right click a project and select **Project | Include Subproject**.
2. Click the Browse button and select the *.ump file that you want to include, e.g. Banking access.ump.


Include Subproject
Kind of include
Include by reference:
Store a reference to the original data of your subproject.
Include subproject elements:
Editable
Readonly
Include as a copy:
Store a copy of the shared data of your subproject in your UModel project file. References to the original data will be lost.
Styles of included diagrams
Retain styles:
Included diagrams will appear as defined in their subproject.
Use project file styles:
Diagrams will use current project file styles.
Bank_MultiLanguage_Java\Banking access.ump
Make path relative to Bank_MultiLanguage
OK
Cancel

3. Choose how the file is to be included; by reference tor as copy.

Saving projects

When saving the main project file, all editable subproject files are also saved. I.e. all data contained in the shared packages of the subproject files are saved.

You should therefore not create/add data (components) outside of the shared/subproject structure, if the subproject is defined as "editable" in a main project file. If data exists outside of the subproject structure, a warning message will be displayed in the Messages window.

Saving subproject files

When saving subprojects (from the main project level) all references to sibling, as well as child subprojects, are considered and saved. E.g. if two sibling subprojects, sub1 and sub2, exist and sub1 uses elements from sub2, then sub1 is saved in such a way that it automatically saves references to sub2 as well.

If sub1 was opened as a "main" project, then it is considered as a self contained project and can be edited without any reference to the actual main project.

Reintegrating subprojects into the main project

Previously defined subprojects can be copied back into the main project again. If the subproject does not contain any diagrams then the reintegration will be immediate. If diagrams exist a dialog box will open.

1. Right click the subproject and select **Subproject | Include as Copy**.
   This opens the "Include Subproject" dialog box, which allows you to define the diagrams styles you want to use when including the subproject.

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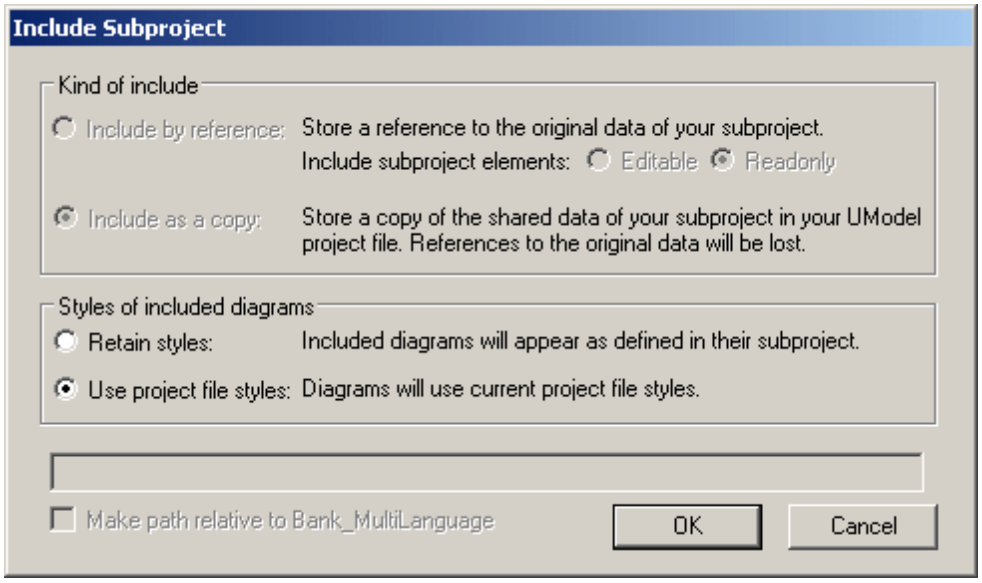

Include Subproject
Kind of include
Include by reference:
Store a reference to the original data of your subproject.
Include subproject elements:
Editable
Readonly
Include as a copy:
Store a copy of the shared data of your subproject in your UModel project file. References to the original data will be lost.
Styles of included diagrams
Retain styles:
Included diagrams will appear as defined in their subproject.
Use project file styles:
Diagrams will use current project file styles.
Make path relative to Bank_MultiLanguage
OK
Cancel

2. Select the style option that you want to use, then click OK to include the project again.

Chapter 12

Source Control

12 Source Control

The source control support in UModel is available through the Microsoft Source Control Plug-in API (formerly known as the MSSCCI API), versions 1.1, 1.2 and 1.3. This enables you to run source control commands such as "Check in" or "Check out" directly from UModel to virtually any source control system that lets native or third-party clients connect to it through the Microsoft Source Control Plug-in API.

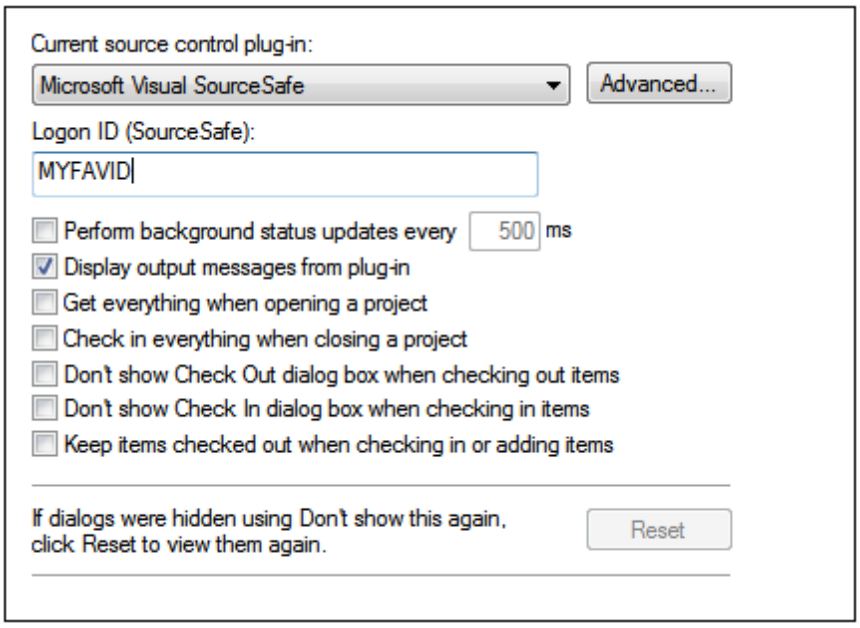
You can use as your source control provider any commercial or non-commercial plug-in that supports the Microsoft Source Control Plug-in API, and can connect to a compatible version control system. For the list of source control systems and plug-ins tested by Altova, see Supported Source Control Systems.

Installing and configuring the source control provider

To view the source control providers available on your system, do the following:

1. On the **Tools** menu, click **Options**.
2. Click the **Source Control** tab.

Any source control plug-ins compatible with the Microsoft Source Code Control Plug-in API are displayed in the **Current source control plug-in** drop-down list.


Current source control plug-in:
Microsoft Visual SourceSafe
Advanced...
Logon ID (SourceSafe):
MYFAVID
Perform background status updates every
500
ms
Display output messages from plug-in
Get everything when opening a project
Check in everything when closing a project
Don't show Check Out dialog box when checking out items
Don't show Check In dialog box when checking in items
Keep items checked out when checking in or adding items
If dialogs were hidden using Don't show this again, click Reset to view them again.
Reset

If a compatible plug-in cannot be found on your system, the following message is displayed:

```
"Registration of installed source control providers could not be found or is
incomplete."
```

Some source control systems might not install the source control plug-in automatically, in which case you will need to install it separately. For further instructions, refer to the documentation of the respective source control system. A plug-in (provider) compatible with the Microsoft Source Code Control Plug-in API is expected to be registered under the following registry entry on your

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operating system:

```
HKEY_LOCAL_MACHINE\SOFTWARE\SourceCodeControlProvider\InstalledSCCProviders
```

Upon correct installation, the plug-in becomes available automatically in the list of plug-ins available to UModel.

Accessing the source control commands

The commands related to source control are available in the **Project | Source Control** menu.

Resource / Speed issues

Very large source control databases might be introducing a speed/resource penalty when automatically performing background status updates.

You might be able to speed up your system by disabling (or increasing the interval of) the **Perform background status updates every ... seconds** option in the **Source Control** tab accessed through **Tools | Options**.

Note: The **64-bit** version of your Altova application automatically supports any of the supported 32-bit source control programs listed in this documentation. When using a 64-bit Altova application with a 32-bit source control program, the **Perform background status updates every ... seconds** option is automatically grayed-out and cannot be selected.

Differencing with Altova DiffDog

You can configure many source control systems (including Git and TortoiseSVN) so that they use Altova DiffDog as their differencing tool. For more information about DiffDog, see http://www.altova.com/diffdog.html. For DiffDog documentation, see http://www.altova.com/documentation.html.

12.1 Setting Up Source Control

The mechanism for setting up source control and placing files in a UModel project under source control is as follows:

1. If this hasn't been done already, install the source control system (see Supported Source Control Systems) and set up the source control database (repository) to which you wish to save your work.
2. Create a local workspace folder that will contain the working files that you wish to place under source control. The folder that contains all your workspace folders and files is called the local folder, and the path to the local folder is referred to as the local path. This local folder will be bound to a particular folder in the repository.
3. In your Altova application, create an application project folder to which you must add the files you wish to place under source control. This organization of files in an application project is abstract. The files in a project reference physical files saved locally, preferably in one folder (with sub-folders if required) for each project.
4. In the source control system's database (also referred to as source control or repository), a folder is created that is bound to the local folder. This folder (called the bound folder) will replicate the structure of the local folder so that all files to be placed under source control are correctly located hierarchically within the bound folder. The bound folder is usually created when you add a file or an application project to source control for the first time.

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12.2 Supported Source Control Systems

The list below shows the Source Control Servers (SCSs) supported by UModel, together with their respective Source Control Clients (SCCs). The list is organized alphabetically by SCS. Note the following:

- Altova has implemented the Microsoft Source Control Plug-in API (versions 1.1, 1.2, and 1.3) in UModel, and has tested support for the listed drivers and revision control systems. It is expected that UModel will continue to support these products if, and when, they are updated.
- Source Code Control clients not listed below, but which implement the Microsoft Source Control Plug-in API, should also work with UModel.

Source Control System	Source Code Control Clients
AccuRev 4.7.0 Windows	AccuBridge for Microsoft SCC 2008.2
Bazaar 1.9 Windows	Aigenta Unified SCC 1.0.6
Borland StarTeam 2008	Borland StarTeam Cross-Platform Client 2008 R2
Codice Software Plastic SCM Professional 2.7.127.10 (Server)	Codice Software Plastic SCM Professional 2.7.127.10 (SCC Plugin)
Collabnet Subversion 1.5.4	• Aigenta Unified SCC 1.0.6 • PushOK SVN SCC 1.5.1.1 • PushOK SVN SCC x64 version 1.6.3.1 • TamTam SVN SCC 1.2.24
ComponentSoftware CS-RCS (PRO) 5.1	ComponentSoftware CS-RCS (PRO) 5.1
Dynamsoft SourceAnywhere for VSS 5.3.2 Standard/Professional Server	Dynamsoft SourceAnywhere for VSS 5.3.2 Client
Dynamsoft SourceAnywhere Hosted	Dynamsoft SourceAnywhere Hosted Client (22252)
SourceAnywhere Standalone 2.2 Server	Dynamsoft SourceAnywhere Standalone 2.2 Client
IBM Rational ClearCase 7.0.1 (LT)	IBM Rational ClearCase 7.0.1 (LT)
March-Hare CVSNT 2.5 (2.5.03.2382)	Aigenta Unified SCC 1.0.6
March-Hare CVS Suite 2008	• Jalindi Igloo 1.0.3 • March-Hare CVS Suite Client 2008 (3321) • PushOK CVS SCC NT 2.1.2.5 • PushOK CVS SCC x64 version 2.2.0.4 • TamTam CVS SCC 1.2.40
Mercurial 1.0.2 for Windows	Sergey Antonov HgSCC 1.0.1
Microsoft SourceSafe 2005 with CTP	Microsoft SourceSafe 2005 with CTP
Microsoft Visual Studio Team System 2008/2010 Team Foundation Server	Microsoft Team Foundation Server 2008/2010 MSSCCI Provider
Perforce 2008 P4S 2008.1	Perforce P4V 2008.1

Source Control System	Source Code Control Clients
PureCM Server 2008/3a	PureCM Client 2008/3a
QSC Team Coherence Server 7.2.1.35	QSC Team Coherence Client 7.2.1.35
Reliable Software Code Co-Op 5.1a	Reliable Software Code Co-Op 5.1a
Seapine Surround SCM Client/Server for Windows 2009.0.0	Seapine Surround SCM Client 2009.0.0
Serena Dimensions Express/CM 10.1.3 for Win32 Server	Serena Dimensions 10.1.3 for Win32 Client
Softimage Alienbrain Server 8.1.0.7300	Softimage Alienbrain Essentials/Advanced Client 8.1.0.7300
SourceGear Fortress 1.1.4 Server	SourceGear Fortress 1.1.4 Client
SourceGear SourceOffsite Server 4.2.0	SourceGear SourceOffsite Client 4.2.0 (Windows)
SourceGear Vault 4.1.4 Server	SourceGear Vault 4.1.4 Client
VisualSVN Server 1.6	• Aigenta Unified SCC 1.0.6 • PushOK SVN SCC 1.5.1.1 • PushOK SVN SCC x64 version 1.6.3.1 • TamTam SVN SCC 1.2.24

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12.3 Source Control Commands

The following sections use Visual SourceSafe to show the source control features of UModel. The examples in this section use the **Bank_CSharp.ump** UModel project (and associated code files) available in the C:\Documents and Settings\<username>\My Documents\Altova\UModel2016 \UModelExamples\ folder. Note that a Source Control project is not the same as a UModel project. Source Control projects are directory dependent, whereas UModel projects are logical constructions without direct directory dependence.

To access the Source Control commands, do one of the following:

- Use the menu command **Project | Source Control**
- Use the **context** menu in the Model Tree
- Click the source control toolbar buttons in the Source Control toolbar. Use **Tools | Customize | Toolbars** to activate the toolbar.

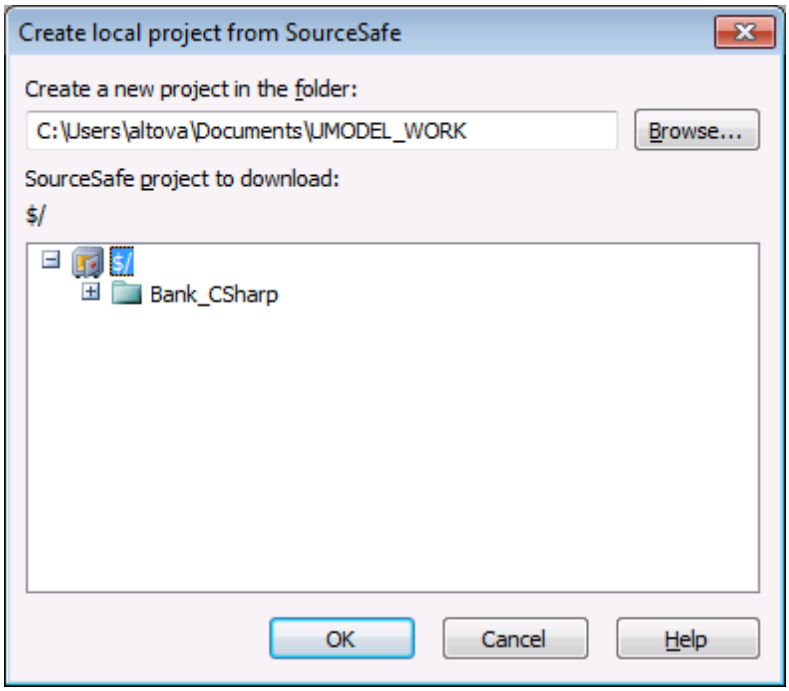
The description of the version control commands that follow apply to the standalone version of UModel. The Visual Studio and Eclipse versions of UModel use the version control functionality and menu items available in those IDEs.

Open from Source Control
Enable Source Control
Get Latest Version
Get
Get Folder(s)
Check Out
Check In
Undo Check Out...
Add to Source Control
Remove from Source Control
Share from Source Control
Show History
Show Differences
Show Properties
Refresh Status
Source Control Manager
Change Source Control

12.3.1 Open from Source Control

The Open from Source Control command creates a local project from an existing source control database, and places it under source control, SourceSafe in this case.

1. Select **Project | Source Control | Open from Source Control.**
   The Login dialog box is opened, enter your login details to continue.
   The "Create local project from SourceSafe" dialog box appears.
2. Define the directory to contain the new local project e.g. c:\temp\ssc. This becomes the **Working directory**, or the Check Out Folder.



3. Select the SourceSafe project you want to download e.g. Bank_CSharp.
   If the folder you define here does not exist at the location, a dialog box opens prompting you to create it.
4. Click **Yes** to create the new directory.
   The Open dialog box is now visible.

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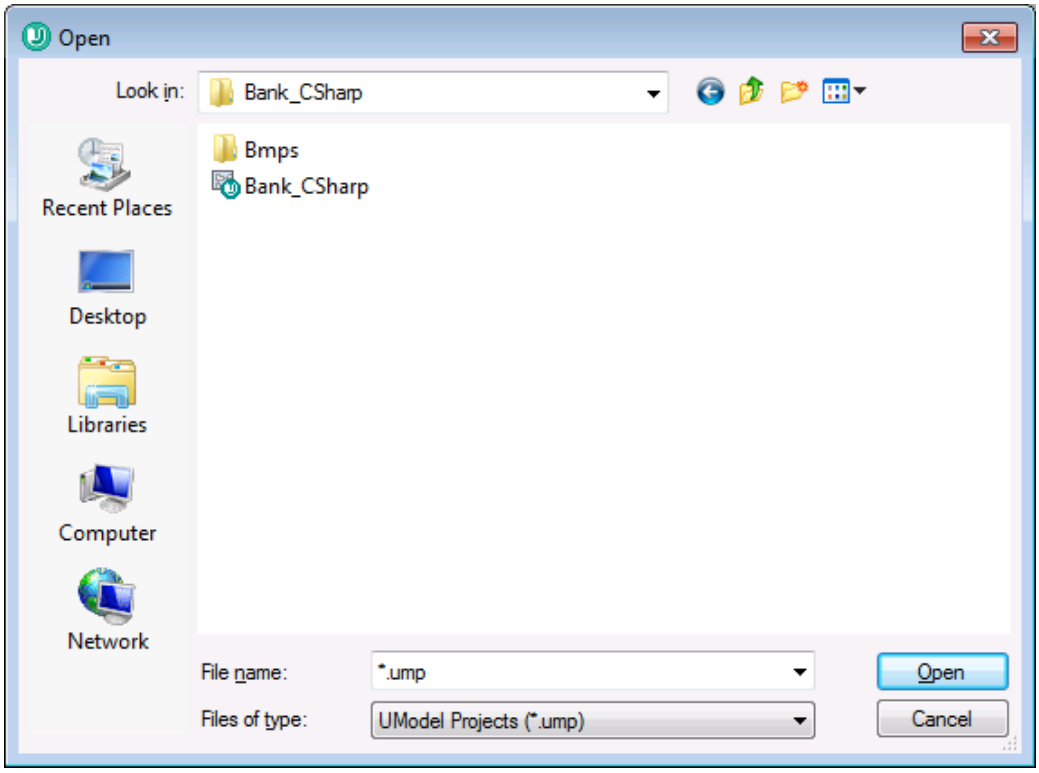


5. Select the **Bank_CSharp.ump** UModel project file and click Open.

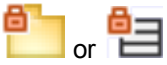
   Bank_CSharp.ump now opens in UModel, and the file is placed under source control. This is indicated by the lock symbol visible on the Root folder in the Model Tree window. The Root folder represents both the project file and the working directory for source control operations.

   The BankCSharp directory has been created locally, you can now work with these files as you normally would.

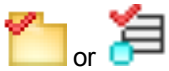
Note:

To place under source control the code files generated when synchronizing code, see: Add to Source Control

Source control symbols:



The lock symbol denotes that the file, or folder is under source control, but is currently not checked out.

 or

The red check mark denotes checked out, i.e. the UModel project file (or code file) has been checked out for editing. The asterisk in the Application title bar denotes that changes have been made to the file, and you will be prompted to save it when you exit.

or

The arrow symbol shows that the file(s) have been checked out by someone else in the network, or by you into a different working directory

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12.3.2 Enable Source Control

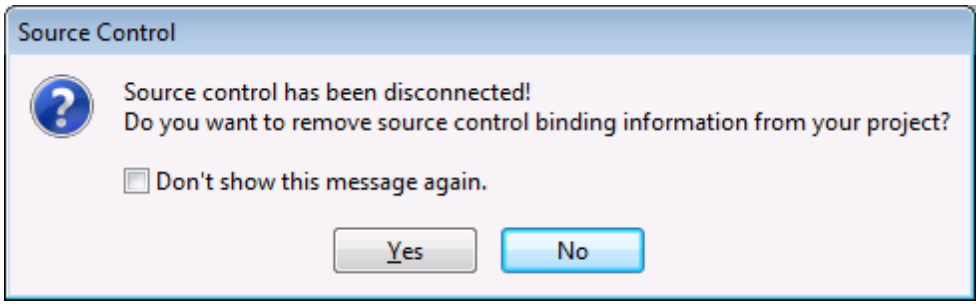
This command allows you to enable or disable source control for a UModel project and is available through the Project menu item, i.e. **Project | Source Control | Enable Source Control**. Selecting this option on any file or folder, enables/disables source control for the whole UModel project.

To enable Source Control for a project:

1. Select the menu option **Project | Source Control** and activate/check the **Enable source control** check box of the fly-out menu. The previous check in/out status of the various files are retrieved and displayed in the Model Tree window.

To disable Source Control for a project:

1. Select the menu option **Project | Source Control** and uncheck the **Enable source control** check box.


Source Control
Source control has been disconnected!
Do you want to remove source control binding information from your project?
Don't show this message again.
Yes
No

You are now prompted if you want to remove the binding information from the project.

To **provisionally** disable source control for the project, select **No**.

To **permanently** disable source control for the project, select **Yes**.

12.3.3 Get Latest Version

Retrieves and places the latest source control version of the selected file(s) in the working directory. The files are retrieved as read-only and are not checked out.

If the affected files are currently checked out, different things occur depending on the specific version control plugin: nothing happens, new data are merged into your local file, or your changes are overwritten.

This command works in a similar fashion to the Get command, but does not display the "Source control - Get" dialog box. It is therefore not possible to specify Advanced get options.

Note that this command automatically performs a recursive get latest version operation when performed on a folder, i.e. it affects all other files below the current one in the package hierarchy.

To get the latest version of a file:

1. Select the file(s) you want to get the latest version of in the Model Tree.
2. Select **Project** | **Source Control** | **Get Latest Version**.

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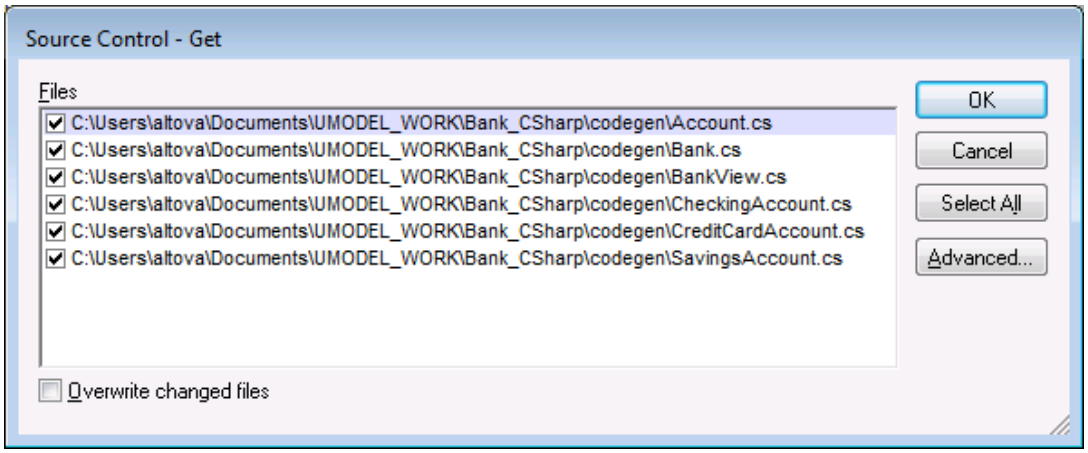
12.3.4 Get

Retrieves a read-only copy of the selected files and places them in the working folder. The files are not checked-out for editing per default.

Using Get:

- Select the files you want to get in the Model Tree.
- Select **Project** | **Source Control** | **Get**.

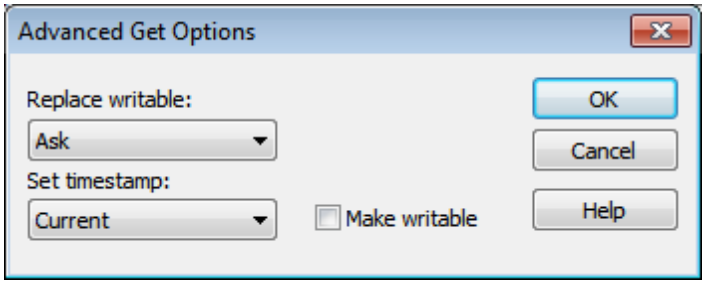


Overwrite changed files
Overwrites those files that have been changed locally with those from the source control database.

Select All
Selects all the files in the list box.

Advanced

Allows you to define the **Replace writable** and **Set timestamp** options in the respective combo boxes.



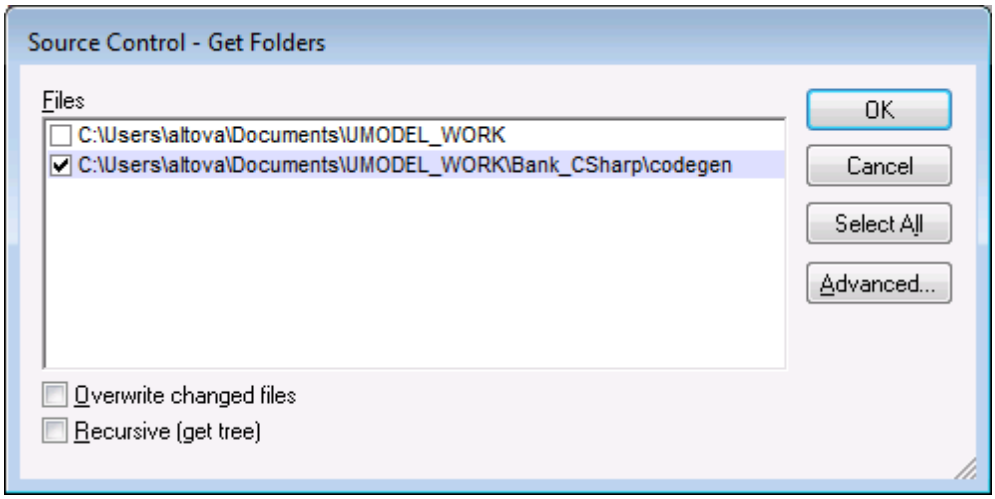
The "Make writable" check box removes the read-only attribute of the retrieved files.

12.3.5 Get Folder(s)

Retrieves read-only copies of files in the selected folders and places them in the working folder. The files are not checked-out for editing per default.

Using Get Folders:

- Select the folder you want to get in the Model Tree.
- Select **Project** | **Source Control** | **Get Folders**.

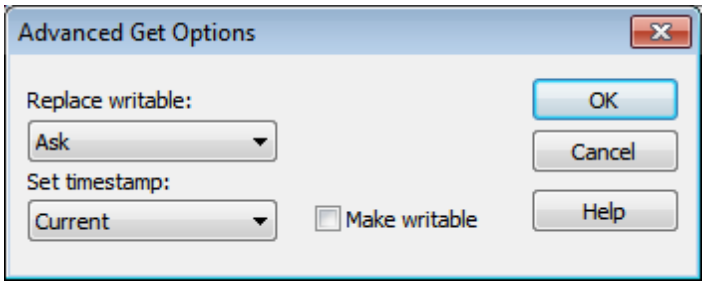


Overwrite changed files
Overwrites those files that have been changed locally with those from the source control database.

Recursive (get tree)
Retrieves all files of the folder tree below the selected folder.

Advanced

Allows you to define the **Replace writable** and **Set timestamp** options in the respective combo boxes.



The "Make writable" check box removes the read-only attribute of the retrieved files.

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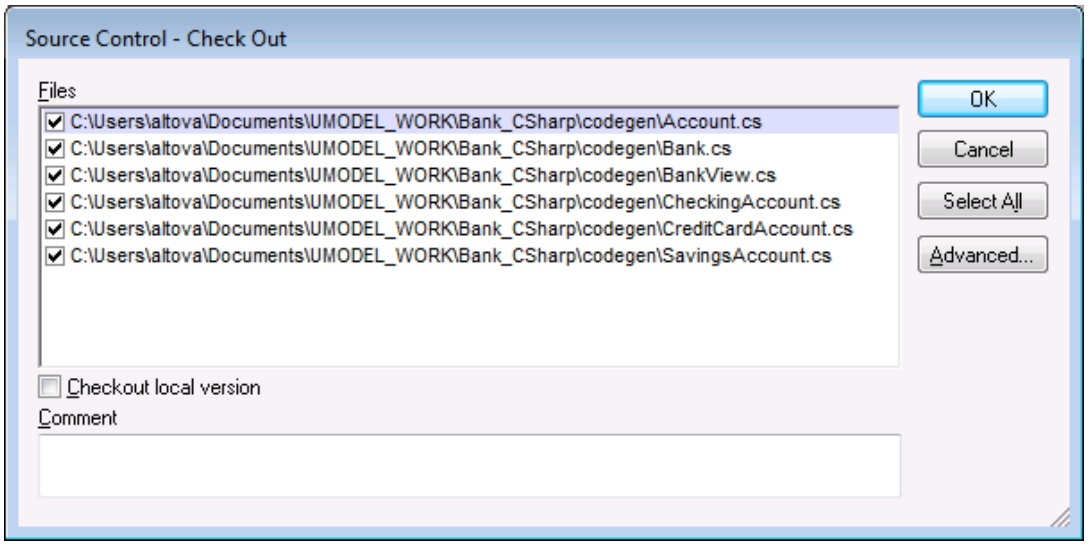
12.3.6 Check Out

This command **checks out** the latest version of the selected files and places writable copies in working directory. The files are flagged as "checked out" for all other users.

To Check Out files:

- Select the file or folder you want to check out in the Model Tree.
- Select **Project** | **Source Control** | **Check Out**.

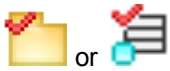


Note:
You can change the number of files to check out, by activating the individual check boxes in the Files list box.

Checkout local version:
Checks out only the local versions of the files, not those from the source control database.

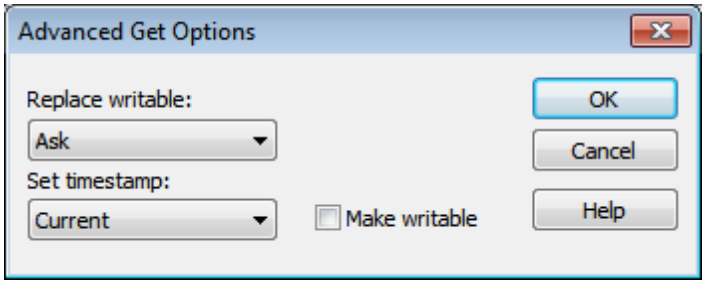
The following items can be checked out:

- Single files, click on the respective files (CTRL + click, in the Model Tree)
- Folders, click on the folders (CTRL + click, in the Model Tree)

 or
The red check mark denotes that the file/folder has been checked out.

Advanced

Allows you to define the **Replace writable** and **Set timestamp** options in the respective combo boxes.



The "Make writable" check box removes the read-only attribute of the retrieved files.

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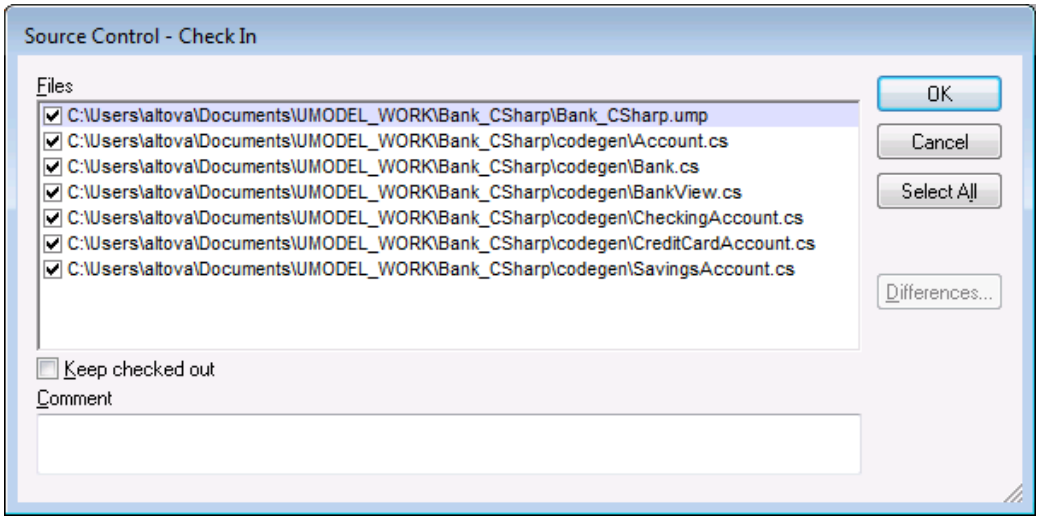
12.3.7 Check In

This command **checks in** the previously checked out files, i.e. your locally updated files, and places them in the source control database.

To Check In files:

- Select the files in the Model Tree
- Select **Project** | **Source Control** | **Check In**.

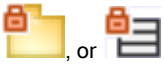
Shortcut: Right-click a checked out item in the project window, and select "Check in" from the Context menu.



Note:
You can change the number of files to check in, by activating the individual check boxes in the Files list box.

The following items can be checked in:

- Single files, click on the respective files (CTRL + click, in Model Tree)
- Folders, click on the folders (CTRL + click, in Model Tree)

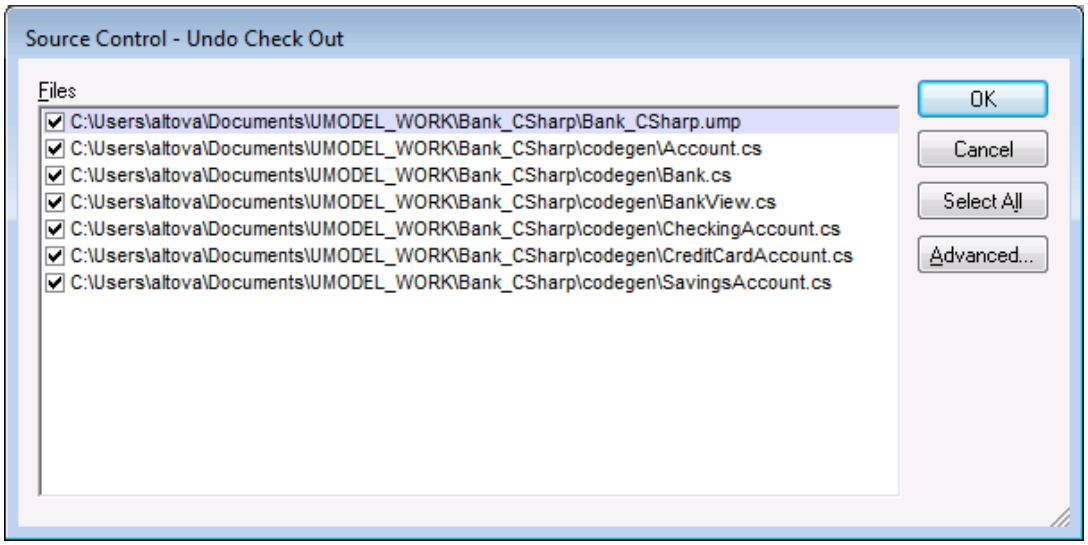
 , or
The lock symbol denotes that the file/folder is **under source control**, but is currently not checked out.

12.3.8 Undo Check Out...

This command **discards changes** made to previously checked out files, i.e. your locally updated files, and retains the old files from the source control database.

To Undo Check Out..

- Select the files in the Model Tree
- Select **Project** | **Source Control** | **Undo Check Out**.

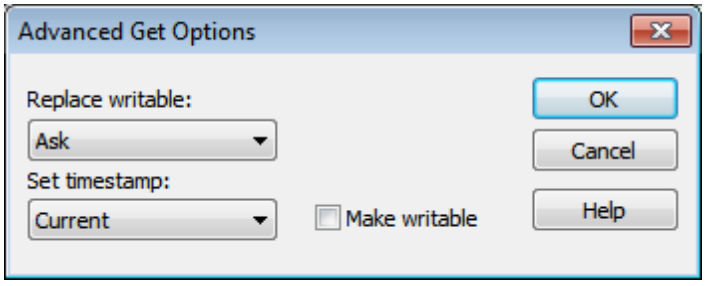


Note:
You can change the number of files by activating the individual check boxes in the Files list box.

The Undo check out option can apply to the following items:
- Single files, click on the respective files (CTRL + click, in Model Tree)
- Folders, click on the folders (CTRL + click, in Model Tree)

Advanced

Allows you to define the **Replace writable** and **Set timestamp** options in the respective combo boxes.



The "Make writable" check box removes the read-only attribute of the retrieved files.

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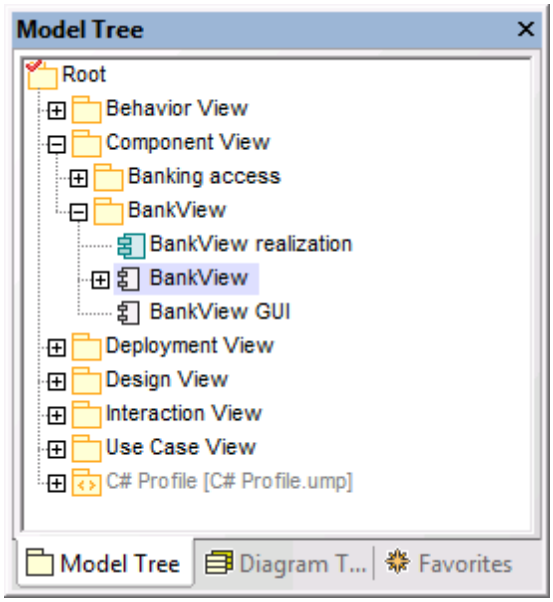
12.3.9 Add to Source Control

Adds the selected files or folders to the source control database and places them under source control. If you are adding a new UModel project you will be prompted for the workspace folder and the location at which your project should be stored.

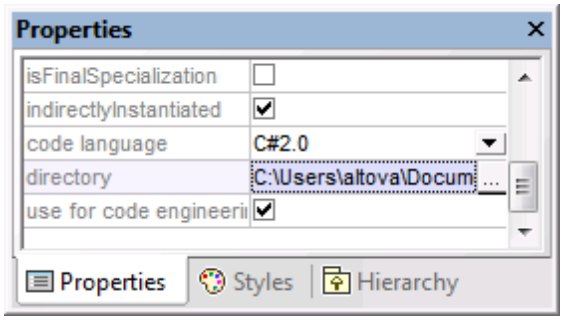
Having placed the UModel project file (*.ump) under source control, you can then add the code files produced by the code-engineering process, to source control as well. For this to work, the generated code files and the UModel project have to be placed **in**, or **under**, the same SourceSafe **working** directory. The working directory used in this section is **C:\Users\Altova \Documents\UMODEL_WORK**.

To add UModel generated code files to source control:

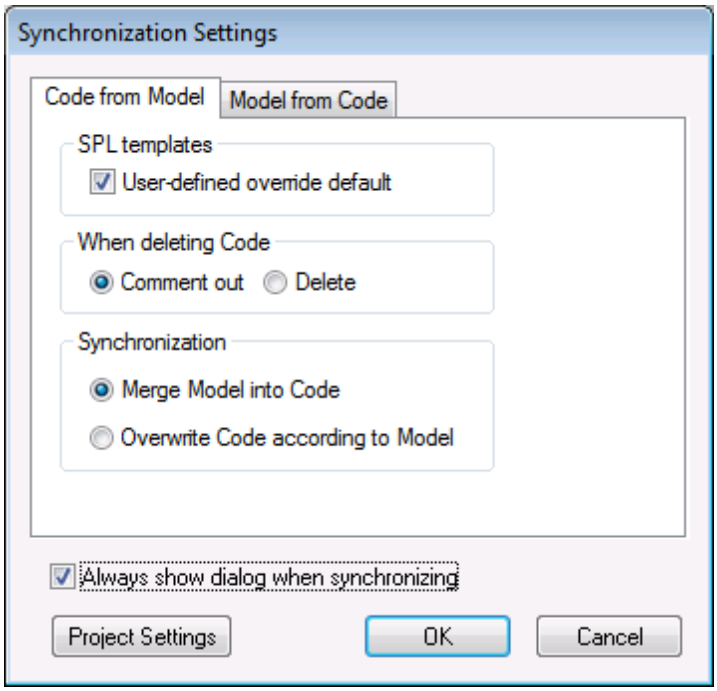
1. Expand the Component View folder in the Model Tree and Navigate to the BankView component.



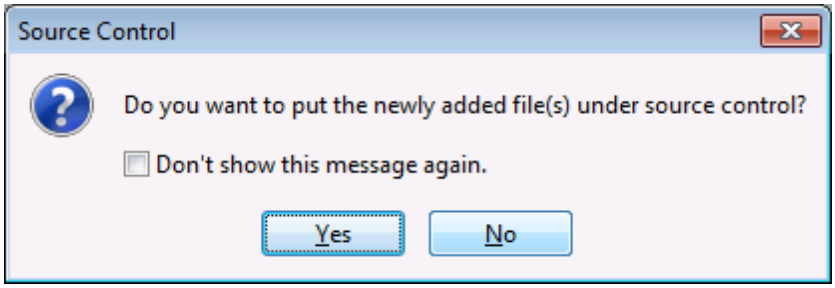
2. Click the BankView component and click the Browse icon next to the "**directory**" field in the Properties window.



3. Change the code engineering directory to **C:\Users\Altova\Documents \UMODEL_WORK\codegen**.
4. Select the menu item **Project | Merge Program Code from UModel project**.
5. Change the Synchronization settings if necessary, and click OK to confirm.



The Messages window displays the code from project process.
A message box opens asking if you want to place the newly created files under source control.



6. Click Yes to do so.
7. The "Add to Source Control" dialog box is opened, allowing you to select the files you want to place under source control.

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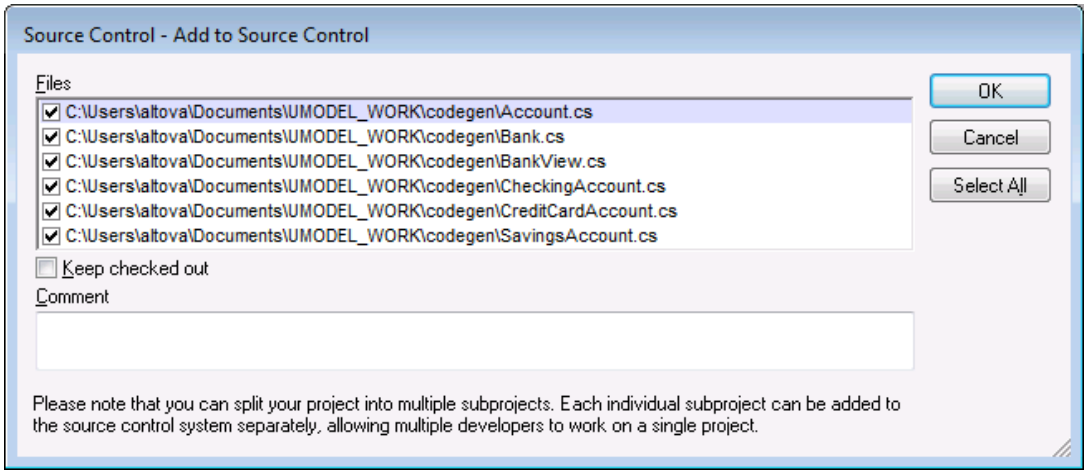
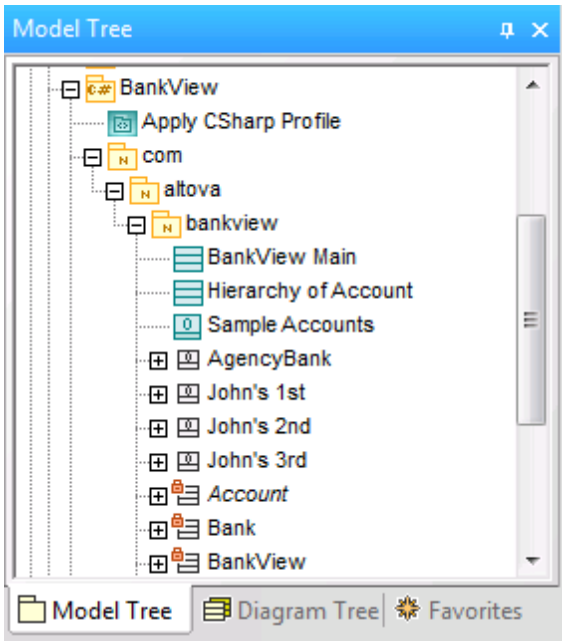


8. Click OK once you have selected the files you want to place under source control. The lock symbol now appears next to each of the classes/file sources placed under source control.

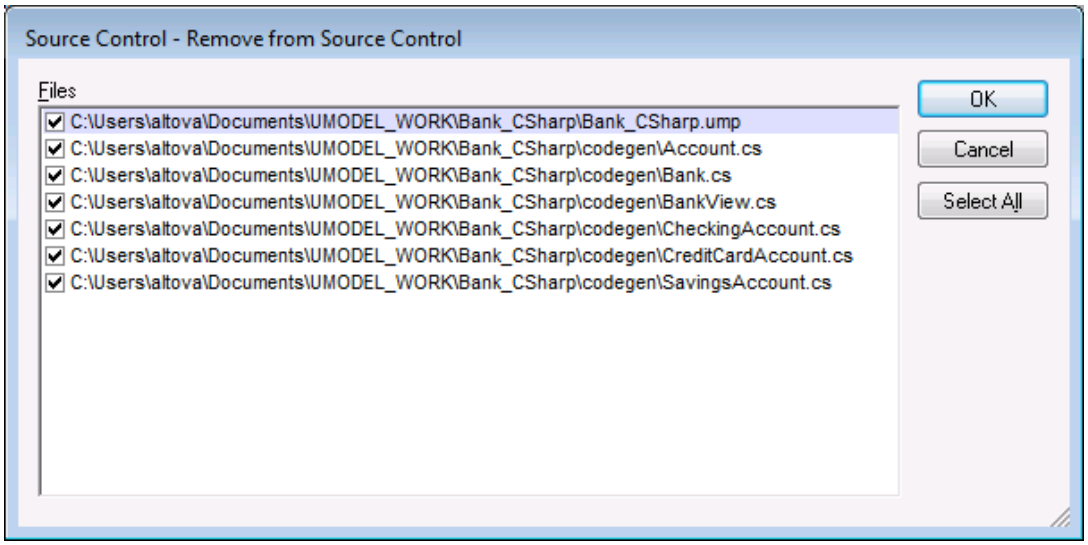


12.3.10 Remove from Source Control

This command **removes** previously added files, from the source control database. These type of files remain visible in the Model Tree but cannot be checked in or out. Use the "Add to Source Control" command to place them back under source control.

To remove files from the source control provider:

- Select the files you want to remove in the Model Tree.
- Select **Project** | **Source Control** | **Remove from Source Control**.



Note:
You can change the number of files to remove, by activating the individual check boxes in the Files list box.

The following items can be removed from source control:

- Single files, click on the respective files (CTRL + click, for several)
- Folders, click on the folder icon.

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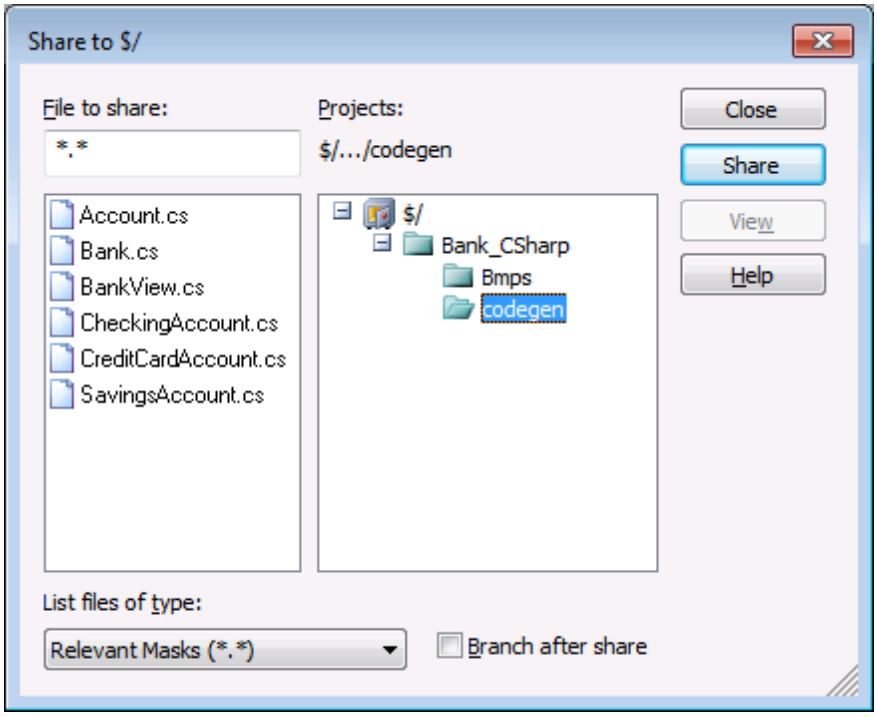
12.3.11 Share from Source Control

This command shares/branches files from other projects/folders within the source control repository, into the selected folder. To use the Share command you must have the Check in/out rights to the project you are sharing from.

To share a file from source control:

1. Select the folder you want to share files to, in the Model Tree window, and select **Project | Source Control | Share from Source Control**. e.g. BankView Component in the Component View folder.
2. Select the project folder that contains the file you want to share in the "Projects" list box.



3. Select the file you want to share in the "Files to share" list box and click the Share button.
   The file is now removed from the "File to share" list.
4. Click the Close button to continue.

Branch after share
Shares the file and creates a new branch to create a separate version.

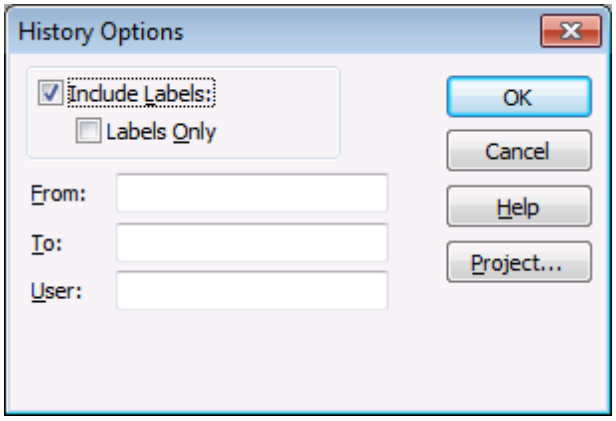
12.3.12 Show History

This command **displays** the history of a file under source control, and allows you to view, see detailed history info, difference, or retrieve previous versions of a file.

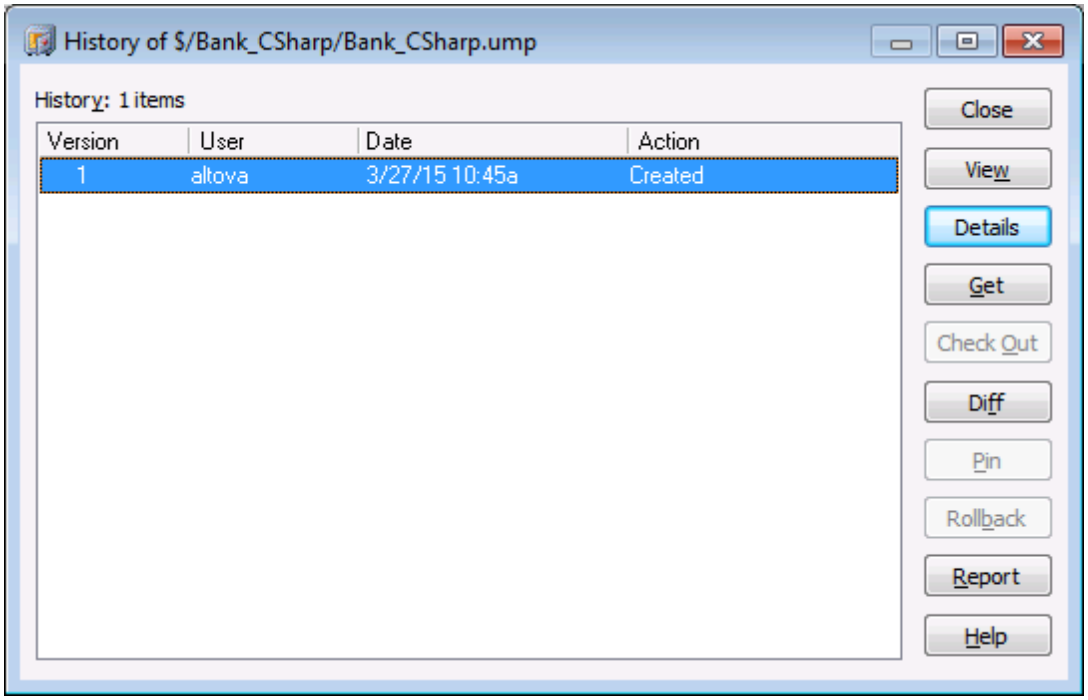
To show the history of a file:

1. Click on the file in the Model Tree window.
2. Select the menu options **Project | Source control | Show history**.

   A dialog box prompting for more information opens.



3. Select the appropriate entries and confirm with **OK**.



This dialog box is provides various way of comparing and getting specific versions of the file in question. Double clicking an entry in the list opens the History Details dialog box for that file.

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Close
Closes this dialog box.

View
Opens a further dialog box in which you can select the type of viewer you want to see the file with.

Details
Opens a dialog box in which you can see the properties of the currently active file.

Get
Allows you to retrieve one of the previous versions of the file in the version list, and place it into the working directory.

Check Out
Allows you to check out the **latest** version of the file.

Diff
Opens the Difference options dialog box, which allows you to define the difference options when viewing the differences between two file versions.

Use CTRL+Click to mark two file versions in this window, then click Diff to view the differences between them.

Pin
Pins or unpins a version of the file, allowing you to define the specific file version to use when differencing two files.

Rollback
Rolls back to the selected version of the file.

Report
Generates a history report which you can send to the printer, file, or clipboard.

Help
Opens the online help of the source control provider plugin.

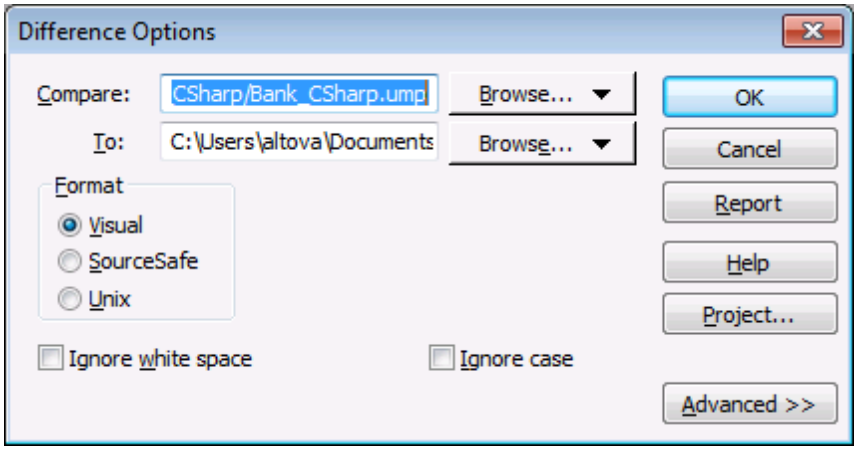
12.3.13 Show Differences

This command **displays** the differences between the file currently in the source control repository, and the **checked in/out** file of the same name in the working directory.

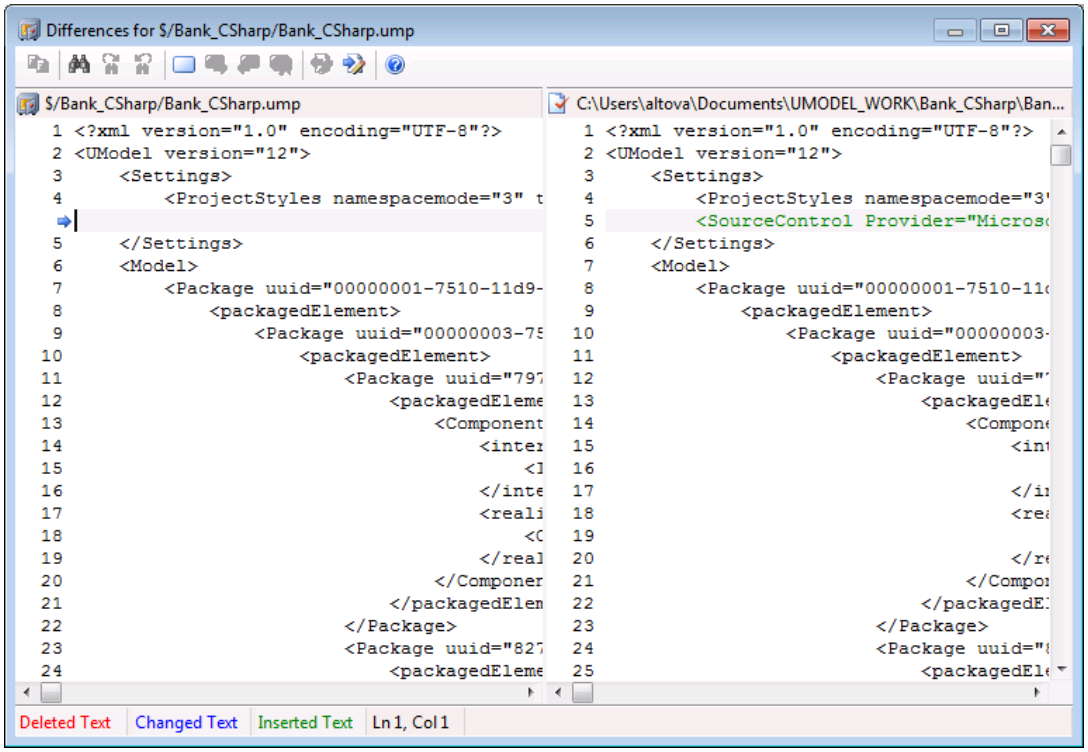
If you have "pinned" one of the files in the **history** dialog box, then the pinned file will be used in the "Compare" text box. Any two files can be selected using the Browse buttons.

To show the differences between two files:

1. Click on a file in the Model Tree window.
2. Select the menu option **Project | Source control | Show Differences**.
   A dialog box prompting for more information appears.



3. Select the appropriate entries and confirm with **OK**.



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The differences between the two files are highlighted in both windows (this example uses MS SourceSafe).

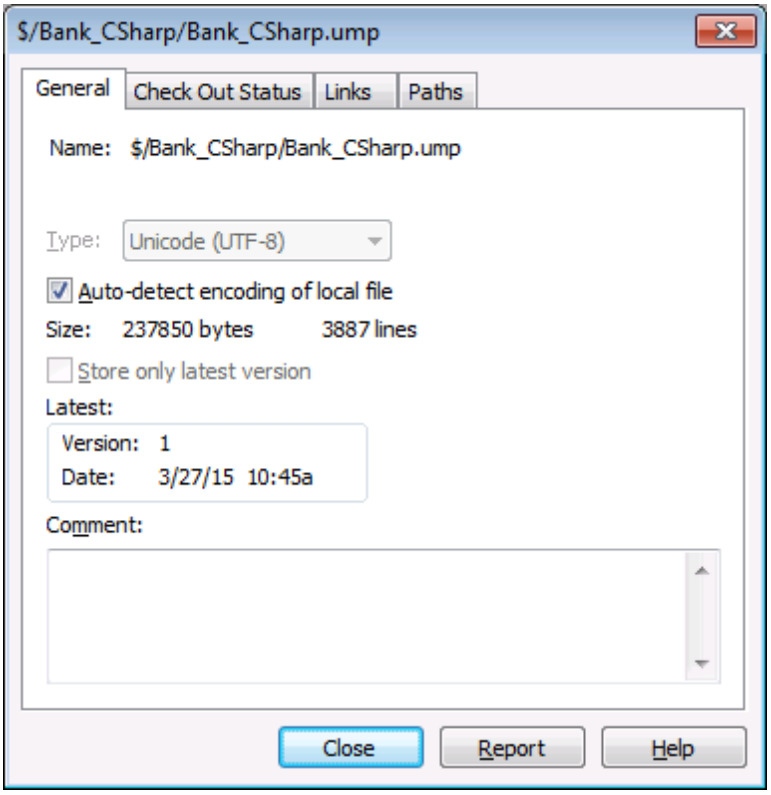
12.3.14 Show Properties

This command **displays** the properties of the currently selected file, and is dependent on the source control provider you use.

To display the properties of the currently selected file:

- Select **Project** | **Source Control** | **Properties**.

This command can only be used on single files.



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12.3.15 Refresh Status

This command **refreshes** the status of all project files, independent of their current status.

12.3.16 Source Control Manager

This command **starts** your source control software with its native user interface.

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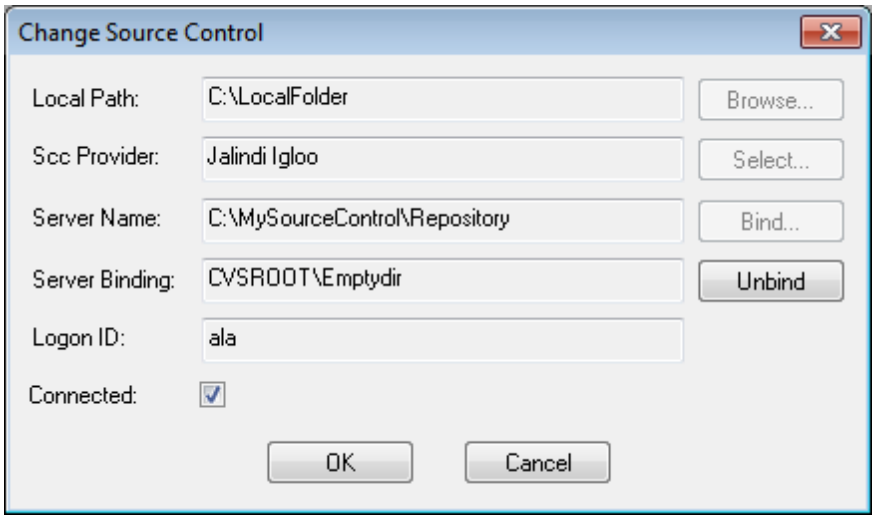
12.3.17 Change Source Control

This dialog box allows you to change the source control binding that you are using. Click the Unbind button first, then (optionally) click the Select button to select a new source control provider, and finally click the Bind button to bind to a new location in the repository.



Chapter 13

UModel Diagram icons

13 UModel Diagram icons

The following section is a quick guide to the icons that are made available in each of the modeling diagrams.

The icons are split up into two sections:

- **Add** - displays a list of elements that can be added to the diagram.
- **Relationship** - displays a list of relationship types that can be created between elements in the diagram.

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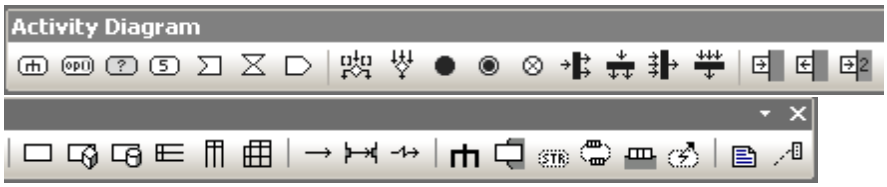
13.1 Activity Diagram



Add
Action (CallBehaviorAction)
Action (CallOperationAction)
AcceptEventAction
AcceptEventAction (TimeEvent)
SendSignalAction

DecisionNode (Branch)
MergeNode
InitialNode
ActivityFinalNode
FlowFinalNode
ForkNode (vertical)
ForkNode (horizontal)
JoinNode
JoinNode (horizontal)

InputPin
OutputPin
ValuePin

ObjectNode
CentralBufferNode
DataStoreNode
ActivityPartition (horizontal)
ActivityPartition (vertical)
ActivityPartition 2-Dimensional

ControlFlow
ObjectFlow
ExceptionHandler

Activity
ActivityParameterNode
StructuredActivityNode
ExpansionRegion
ExpansionNode
InterruptibleActivityRegion

Note
Note Link

13.2 Class Diagram

Relationship:
Association
Aggregation
Composition
AssociationClass
Dependency
Usage
InterfaceRealization
Generalization

Add:
Package
Class
Interface
Enumeration
Datatype
PrimitiveType
Profile
Stereotype
ProfileApplication
InstanceSpecification

Note
Note Link

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13.3 Communication diagram

Add
Lifeline
Message (Call)
Message (Reply)
Message (Creation)
Message (Destruction)

Note
Note Link

13.4 Composite Structure Diagram

Add
Collaboration
CollaborationUse
Part (Property)
Class
Interface
Port

Relationship
Connector
Dependency (Role Binding)
InterfaceRealization
Usage

Note
Note Link

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13.5 Component Diagram

Add:
Package
Interface
Class
Component
Artifact

Relationship:
Realization
InterfaceRealization
Usage
Dependency

Note
Note Link

13.6 Deployment Diagram

Add:
Package
Component
Artifact
Node
Device
ExecutionEnvironment

Relationship:
Manifestation
Deployment
Association
Generalization
Dependency

Note
Note Link

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13.7 Interaction Overview diagram

Add

CallBehaviorAction (Interaction)
CallBehaviorAction (InteractionUse)
DecisionNode
MergeNode
InitialNode
ActivityFinalNode
ForkNode
ForkNode (Horizontal)
JoinNode
JoinNode (Horizontal)
DurationConstraint

Relationship

ControlFlow

Note
Note Link

13.8 Object Diagram

Relationship:
Association
AssociationClass
Dependency
Usage
InterfaceRealization
Generalization

Add:
Package
Class
Interface
Enumeration
Datatype
PrimitiveType
InstanceSpecification

Note
Note Link

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13.9 Package diagram

Add
Package
Profile

Relationship
Dependency
PackageImport
PackageMerge
ProfileApplication

Note
Note Link

13.10 Profile Diagram

Add
Profile
Stereotype

Relationship
Generalization
ProfileApplication
PackageImport
ElementImport

Note
NoteLink

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13.11 Protocol State Machine

Add
Simple state
Composite state
Orthogonal state
Submachine state

FinalState
InitialState

EntryPoint
ExitPoint
Choice
Junction
Terminate
Fork
Fork (horizontal)
Join
Join (horizontal)
ConnectionPointReference

Relationship
Protocol Transition

Note
Note link

13.12 Sequence Diagram

Add
Lifeline
CombinedFragment
CombinedFragment (Alternatives)
CombinedFragment (Loop)
InteractionUse
Gate
StateInvariant
DurationConstraint
TimeConstraint

Message (Call)
Message (Reply)
Message (Creation)
Message (Destruction)

Asynchronous Message (Call)
Asynchronous Message (Reply)
Asynchronous Message (Destruction)

Note
Note Link

No message numbering
Simple message numbering
Nested message numbering

Toggle dependent message movement
Toggle automatic creation of replies for messages
Toggle automatic creation of operations in target by typing operation names

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13.13 State Machine Diagram

Add
Simple state
Composite state
Orthogonal state
Submachine state

FinalState
InitialState

EntryPoint
ExitPoint
Choice
Junction
Terminate
Fork
Fork (horizontal)
Join
Join (horizontal)
DeepHistory
ShallowHistory
ConnectionPointReference

Relationship
Transition

Note
Note link

Toggle automatic creation of operations in target by typing operation names

13.14 Timing Diagram

Add
Lifeline (State/Condition)
Lifeline (General value)
TickMark
Event/Stimulus
DurationConstraint
TimeConstraint

Message (Call)
Message (Reply)
Asynchronous Message (Call)

Note
Note Link

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13.15 Use Case diagram

Add:
Package
Actor
UseCase

Relationship:
Association
Generalization
Include
Extend

Note
Note Link

13.16 XML Schema diagram

Add
XSD TargetNamespace
XSD Schema
XSD Element (global)
XSD Group
XSD ComplexType
XSD ComplexType (simpleContent)
XSD SimpleType
XSD List
XSD Union
XSD Enumeration
XSD Attribute
XSD AttributeGroup
XSD Notation
XSD Import

Relationship
XSD Include
XSD Redefine
XSD Restriction
XSD Extension
XSD Substitution

Note
Note link

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Chapter 14

Menu Reference

14 Menu Reference

The following section lists all the menus and menu options in UModel, and supplies a short description of each.

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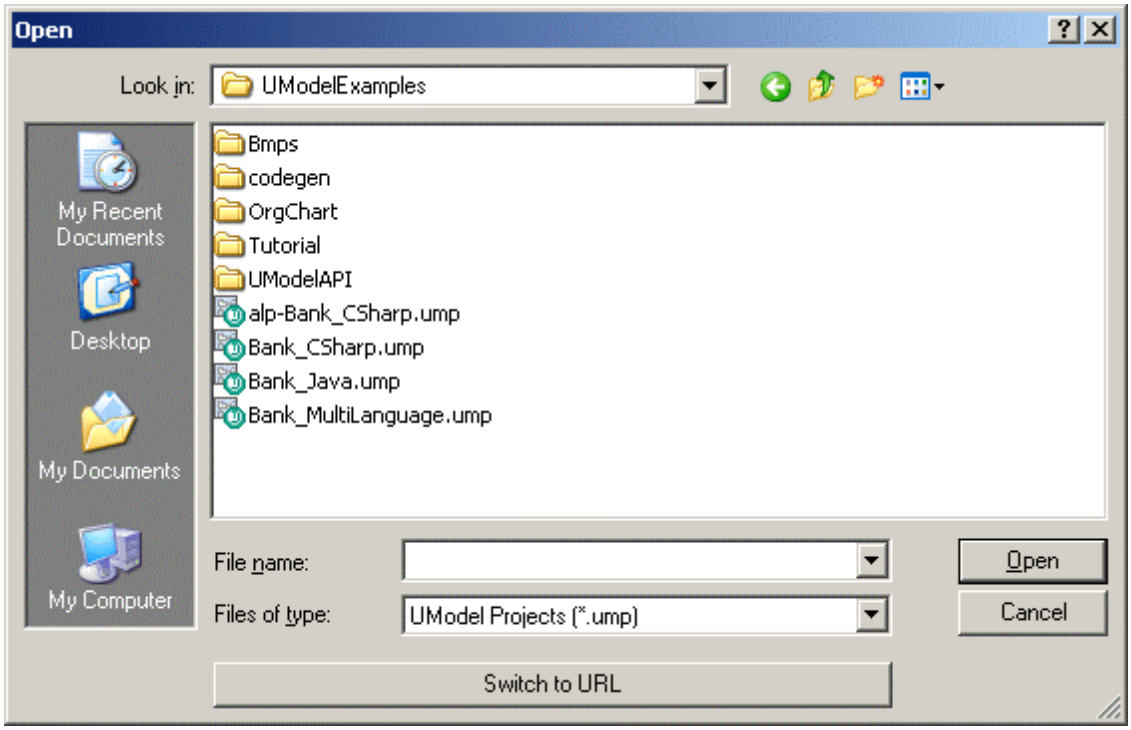
14.1 File

New
Clears the diagram tab, if a previous project exists, and creates a new UModel project.

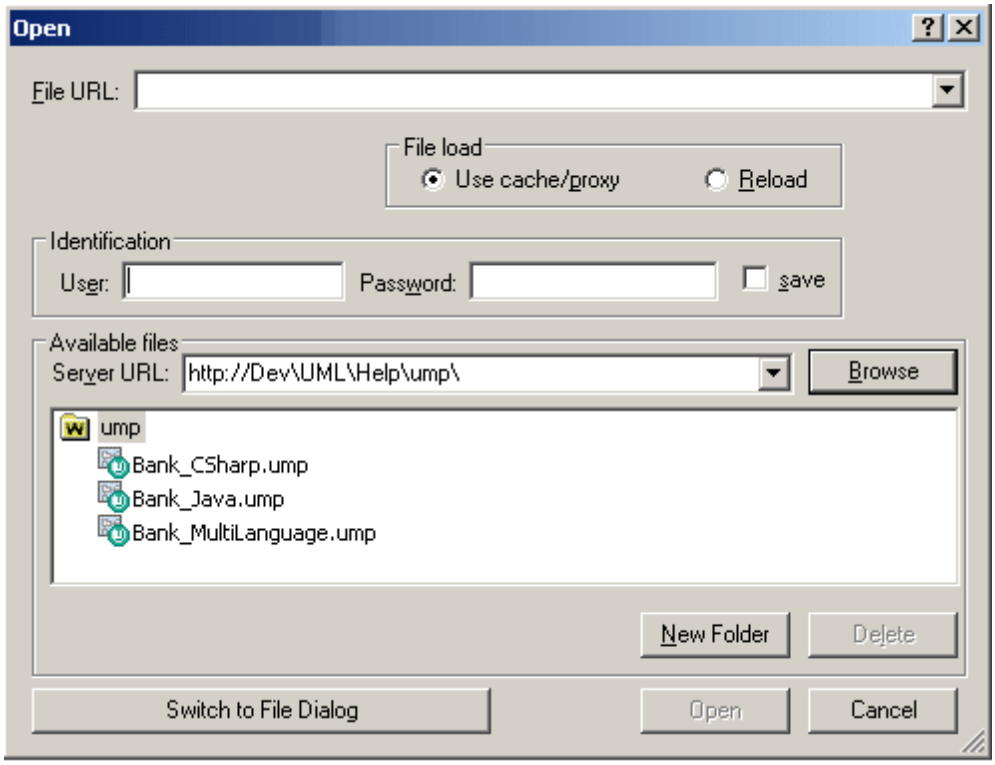
Open
Opens previously defined modeling project. Select a previously saved project file ***.ump** from the Open dialog box.

The standard Open dialog is shown below. Please note the "Switch to URL..." button at the base of the dialog box.



The **Switch to URL** button changes the appearance of the dialog box and allows you to open a UModel project file from an URL.

1. Enter the URL you want to access, in the **Server URL** field.
2. Enter your User-ID in the **User** and **Password** fields, if the server is password protected.
3. Click **Browse** to view and navigate the directory structure of the server.
4. Click the file you want to load into UModel. If the server is a Microsoft® SharePoint® Server, check the *Microsoft® SharePoint® Server* check box. See the Microsoft® SharePoint® Server Notes below for further information about working with files on this type of server.



The file URL now appears in the File URL field at the top of the dialog box. The **Open** button only becomes active at this point.

5. Click the **Open** button to load the file. The file appears in the main window.

   Please note: The Browse function is only available on servers which support WebDAV and on Microsoft SharePoint Servers. The supported protocols are FTP, HTTP, and HTTPS.

   To give you more control over the loading process, you can choose to load the file through the local cache or a proxy server (which considerably speeds up the process if the file has been loaded before). Alternatively, you may want to reload the file if you are working, say, with an electronic publishing or database system; select the Reload option in this case.

Microsoft® SharePoint® Server Notes

Note the following points about files on Microsoft® SharePoint® Servers:

- In the directory structure that appears in the Available Files pane, file icons have symbols that indicate the check-in/check-out status of files.

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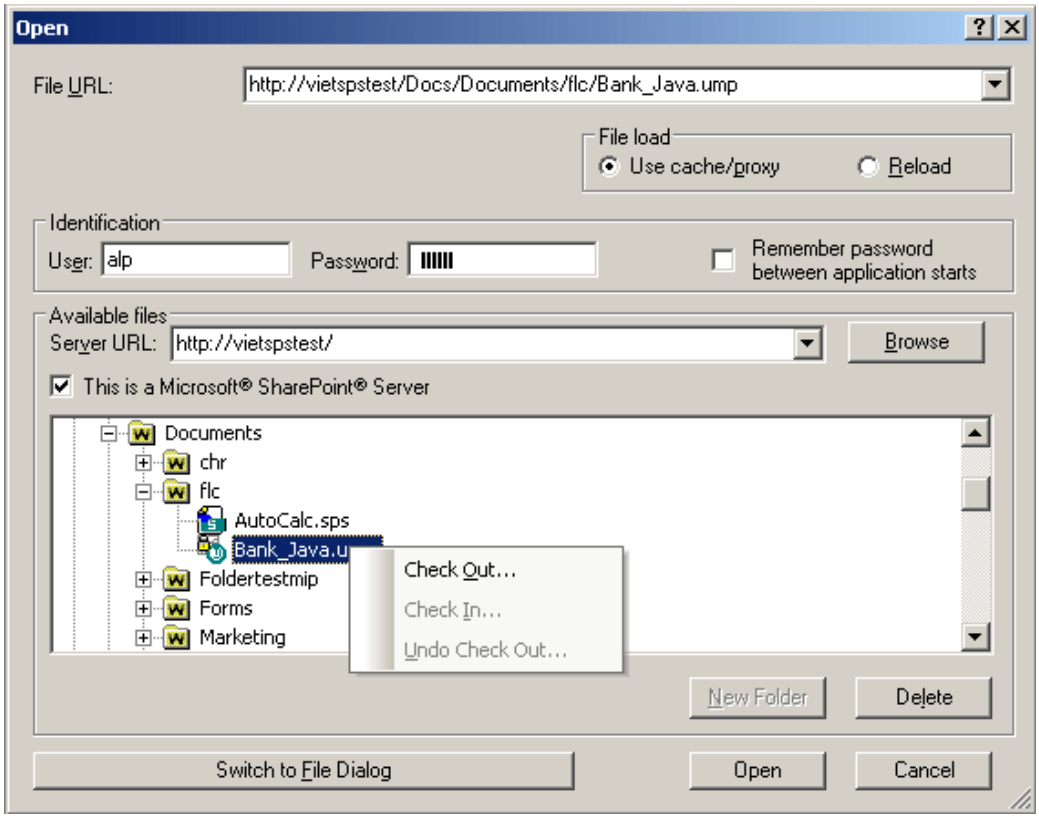


Right-clicking a file pops up a context menu containing commands available for that file.

- The various file icons are shown below:

	Checked in. Available for check-out.
	Checked out by another user. Not available for check-out.
	Checked out locally. Can be edited and checked-in.

- After you check out a file, you can edit it in your Altova application and save it using **File | Save (Ctrl+S)**.
- You can check-in the edited file via the context menu in the Open URL dialog (*see screenshot above*).
- When a file is checked out by another user, it is not available for check out.
- When a file is checked out locally by you, you can undo the check-out with the Undo Check-Out command in the context menu. This has the effect of returning the file unchanged to the server.
- If you check out a file in one Altova application, you cannot check it out in another Altova application. The file is considered to be already checked out to you. The available commands at this point in any Altova application supporting Microsoft® SharePoint® Server will be: **Check In** and **Undo Check Out**.

Reload
Allows you to reload the current project and save, or discard, the changes made since you opened the project file.

Save
Saves the currently active modeling project using the currently active file name.

Save as
Saves the currently active modeling project with a different name, or allows you to give the project a new name if this is the first time you save it.

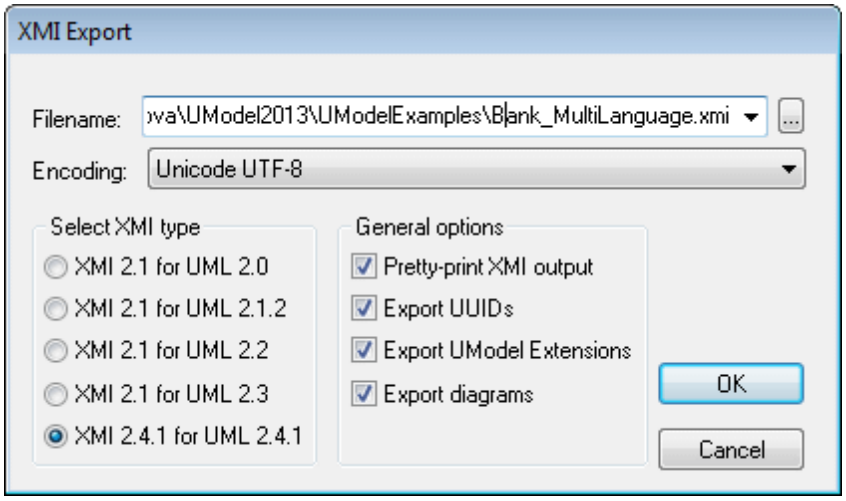
Save Copy As
Allows you to save a copy of the currently active UModel project with a different file name.

Save Diagram as Image
Opens the "Save as..." dialog box and allows you to save the currently active diagram as a .PNG, or .EMF (enhanced metafile) file. Very large PNG files, in the gigabyte range, can now be saved.

Save all Diagrams as Images
Save all diagrams of the currently active project as a .PNG, or .EMF (enhanced metafile) files.

Import from XMI file
Imports a previously exported XMI file. If the file was produced with UModel, then all extensions etc. will be retained.

Export to XMI file
Export the model as an XMI file. You can select the UML version, as well as the specific IDs that you want to export please see XMI - XML Metadata Interchange for more information.



Send by Mail
Opens your default mail application and inserts the current UModel project as an attachment.

Print
Opens the Print dialog box, from where you can print out your modeling project as hardcopy.

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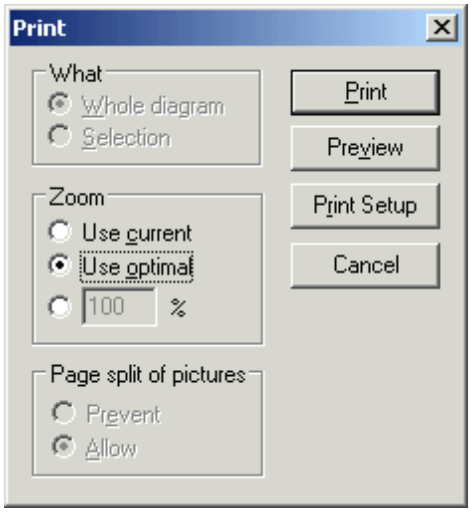


"Use current", retains the currently defined zoom factor of the modeling project. Selecting this option enables the "Page split of pictures" group.

The Prevent option prevents modeling elements from being split over a page, and keeps them as one unit.

"Use optimal" scales the modeling project to fit the page size. You can also specify the zoom factor numerically.

Print all diagrams
Opens the Print dialog box and prints out all UML diagrams contained in the current project file.

Print Preview
Opens the same Print dialog box with the same settings as described above.

Print Setup
Opens the Print Setup dialog box in which you can define the printer you want to use and the paper settings.

14.2 Edit

Undo
UModel has an unlimited number of "Undo" steps that you can use to retrace you modeling steps.

Redo
The redo command allows you to redo previously undone commands. You can step backward and forward through the undo history using both these commands.

Cut/Copy//Delete
The standard windows Edit commands, allow you to cut, copy, etc., modeling elements, please see "Cut, copy and paste in UModel Diagrams" for more information.

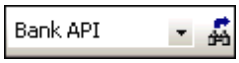
Paste
using the keyboard shortcut CTRL+V, or "Paste" from the context menu, as well as Paste from the Edit menu, always adds a **new** modeling element to the diagram and to the Model Tree, please see "Cut, copy and paste in UModel Diagrams".

Paste in Diagram only
using the context menu, i.e. right clicking on the diagram background, only adds a "link/view" of the existing element, to the current diagram and not to the Model Tree, please see "Cut, copy and paste in UModel Diagrams".

Delete from Diagram only
Deletes the selected modeling elements from the currently active diagram. The deleted elements are not deleted from the modeling project and are available in the Model Tree tab. Note that this option is not available to delete properties or operations from a class, they can be selected and deleted there directly.

Select all
Select all modeling elements of the currently active diagram. Equivalent to the CTRL+A shortcut.

Find
There are several options you can use to search for modeling elements:

- Use the text box in the Main **title bar** 

- Use the menu option Edit | Find
- Press the shortcut **CTRL+F** to open the find dialog box.

Allows you to search for specific text in:

- Any of the three Model Tree panes: Model Tree, Diagram Tree and Favorites tab.

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- The Documentation tab of the Overview pane.
- Any currently active diagram.
- The Messages pane.

Find Next **F3**
Searches for the next occurrence of the same search string in the currently active tab or diagram.

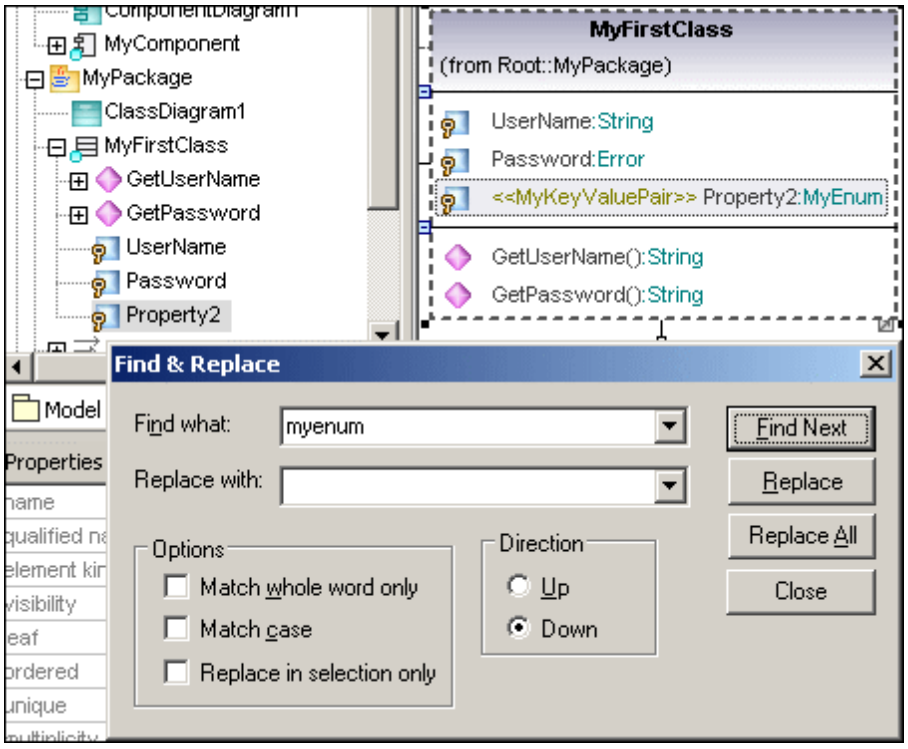
Find Previous SHIFT+F3
Searches for the previous occurrence of the same search string in the currently active tab or diagram.

Replace

Allows you to search and replace any modelling elements in the project. When the element is found it is highlighted in the diagram as well as in the Model Tree.

Search and replace works in:

- All diagrams
- Any of the three Model Tree panes: Model Tree, Diagram Tree and Favorites tab.
- The Documentation tab of the Overview pane.



Copy as bitmap
Copies the currently active diagram into the clipboard from where you can paste it into the application of your choice.

Please note:
Diagrams are copied into the system clipboard, you have to insert them into another application to see, or get access to them.

Copy selection as bitmap
Copies the currently **selected diagram elements** into the clipboard from where you can paste them into the application of your choice.

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14.3 Project

Check Project Syntax...

Checks the UModel project syntax. The project file is checked on multiple levels detailed in the tables below:

Level	Checks if...	Message...
Project level	at least one Java Namespace Root exists	Error
Components	Project file / Directory is set	Error
	If Realization exists	Error
	"Use for code engineering" check box unchecked: no check is performed and syntax check is disabled.	None
Class	Code file name is set.	**Error** if the local option "Generate missing code file names" is not set. **Warning** if the option is set.
	If class is nested then no check performed.	
	If contained in a code language namespace	Error
	Type for operation parameter is set	Error
	Type for properties is set	Error
	Operation return type is set	Error
	Duplicate operations (names + parameter types)	Error
	If classes are involved in Realization, only if the class is not nested.	Warning
Interface	Code file name is set.	**Error** if the local option "Generate missing code file names" is not set. **Warning** if the option is set.
	Contained in a code language namespace	Error
	Type for properties are set	Error
	Type for operation param. are set	Error
	Operation return type is set	Error
	Duplicate operations (names + parameter types)	Error
	If interfaces are involved in a ComponentRealization	Warning
Enumeration	Belongs to Java Namespace Root: gives a warning to say that no code will be generated.	Warning
	Does not belong to Java Namespace Root: no check is performed and syntax check is disabled for the enumeration. No check is performed on	None

contained package

Syntax check for all UML elements involved in code generation

class	Checks name is a valid Java name (no forbidden characters, name is not a keyword)	Error
class property	Checks name is a valid Java name (no forbidden characters, name is not a keyword)	Error
class operation	Checks name is a valid Java name (no forbidden characters, name is not a keyword) Checks for existence of return parameter	Error
class operation parameter	Checks name is a valid Java name (no forbidden characters, name is not a keyword) Checks type has a valid Java type name	Error
interface	Checks name is a valid Java name (no forbidden characters, name is not a keyword)	Error
interface operation	Checks name is a valid Java name (no forbidden characters, name is not a keyword)	Error
interface operation parameter	Checks name is a valid Java name (no forbidden characters, name is not a keyword)	Error
interface properties	Checks name is a valid Java name (no forbidden characters, name is not a keyword)	Error
package with stereotype namespace	Checks name is a valid Java name (no forbidden characters, name is not a keyword)	Error
package without stereotype namespace	no element to check	None
class	multiple inheritance	Error

Please note:
Constraints on model elements are not checked, as they are not part of the Java code generation process. Please see "constraining model elements" for more information.

Source control

See Source control systems for detailed information on source control servers and clients and how to use them.

Import Source Directory...

Opens the Import Source Directory wizard shown below. Please see "Round-trip engineering (code - model - code)" for a specific example.

Import Source Project...

Opens the Import Source Project wizard shown below. Clicking the browse button allows you to select the project file and the specific project type. Please see "Importing source code into

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projects" for a specific example.

Java projects:

- JBuilder **.jpx,** Eclipse **.project** project files, as well as NetBeans (project.**xml**) are currently supported.

C# projects:

- MS Visual Studio projects, **csproj**, **csdprj**..., as well as
- Borland **.bdsproj** project files

VB.NET projects:

- MS Visual Studio projects, **vbproj**, **vbdproj**.

Import Binary Types

Opens the Import Binary Types dialog box allowing you to import Java, C#, and VB binary files. Please see "Importing Java, C#, and VB binaries" for more information.

Import XML Schema directory

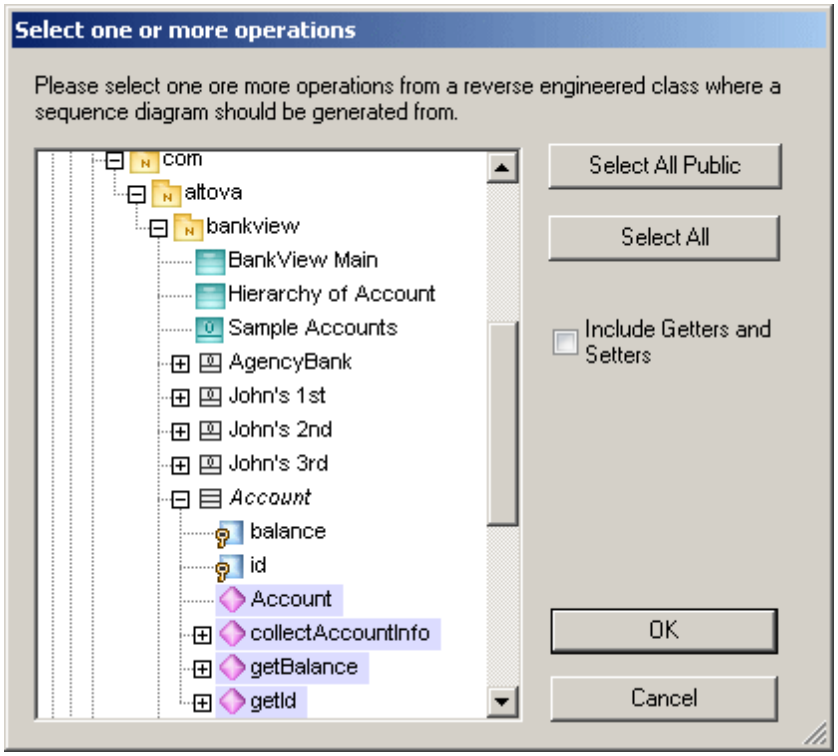
Opens the Import XML Schema Directory allowing you to import all XML Schemas in that directory and optionally all XML Schemas in any of the subfolders.

Import XML Schema File

Opens the Import XML Schema File dialog box allowing you to import schema files. Please see "XML Schema Diagrams" for more information.

Generate Sequence diagrams...

Opens the Select Operations dialog box, in which you select (multiple) operations that are to be the basis of the generated Sequence diagram.



Having selected the operations and clicked OK, the Sequence Diagram Generation dialog box is opened allowing you to further define the generation settings.

Merge Program Code from UModel Project

Opens the Synchronization Settings dialog box with the "**Code from Model**" tab active. Clicking the Project Settings button allows you to select the specific programming language settings.

Merging or overwriting code
Assuming that code has been generated once from a model, and changes have since been made to both model and code e.g.:

- Model elements have been added in UModel e.g. a new class X
- A new class has been added to the external code e.g. class Y

Merging (model into code) means that:

- the newly added class Y in the external code is **retained**
- the newly added class X, from UModel, is added to the code.

Overwriting (code according to model) means that:

- the newly added class Y in the external code is **deleted**
- the newly added class X, from UModel, is added to the code.

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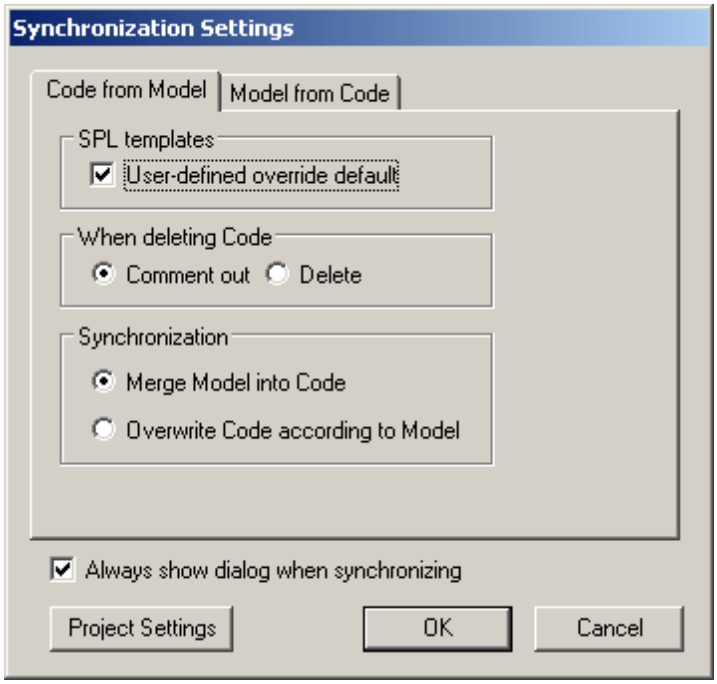


Merge UModel Project from Program Code

Opens the Synchronization Settings dialog box with the "**Model from Code**" tab active. Clicking the Project Settings button allows you to select the specific programming language settings.

Merging or overwriting code

Assuming that code has been generated once from a model, and changes have since been made to both model and code e.g.:

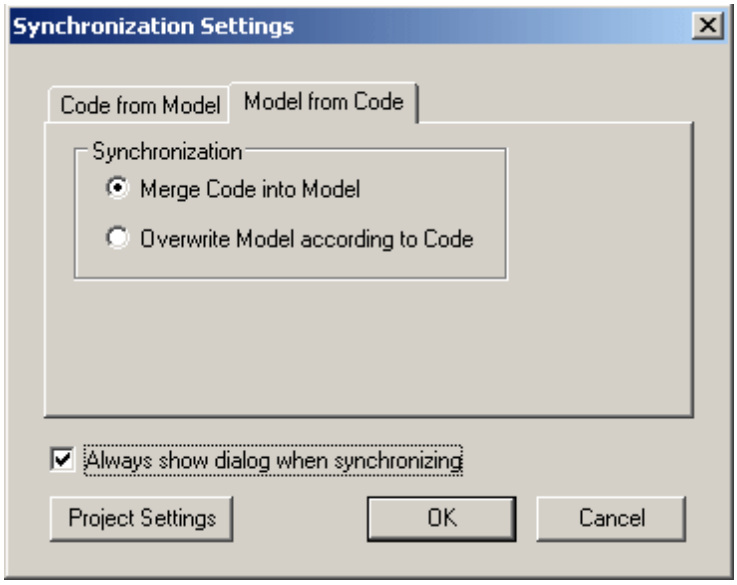
- Model elements have been added in UModel e.g. a new class X
- A new class has been added to the external code e.g. class Y

Merging (code into model) means that:

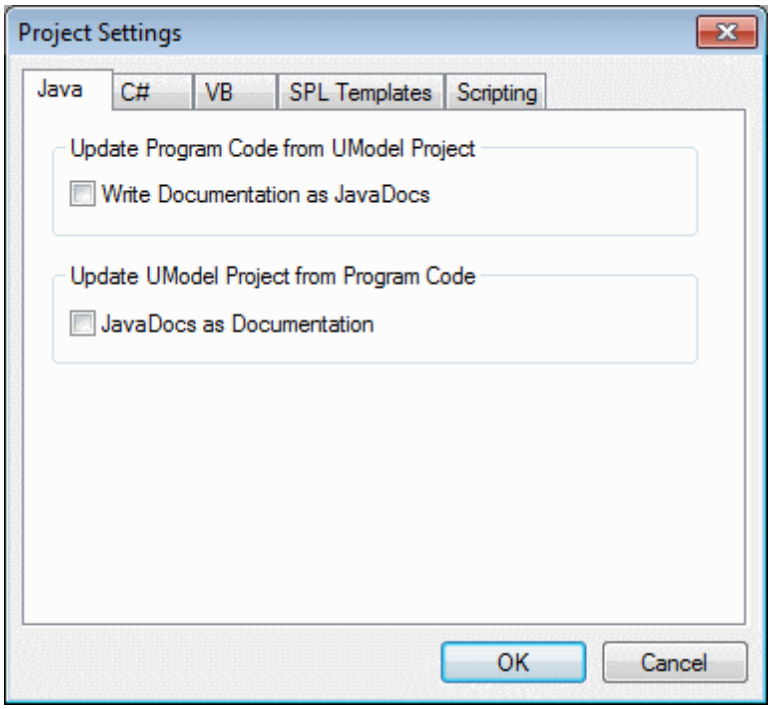
- the newly added class X in UModel, is retained
- the newly added class Y, from the external code, is added to the model

Overwriting (Model according to code) means that:

- the newly added class X in UModel is deleted
- the newly added class Y, from the external code, is added to the model



Project settings
Allows you to define the specific languages settings for your project.



Synchronization Settings...
Opens the Synchronization Settings dialog box as shown in the screenshots above.

Merge Project...
Merges two UModel project files into one model. The first file you open is the one the second file will be merged into. Please see Merging UModel projects for more information.

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Include Subproject
See Including other UModel projects.

Open Subproject as project
Opens the selected subproject as a new project.

Clear Messages
Clears the syntax check and code merging messages, warnings and errors from the Messages window.

Please note:
Errors are generally problems that must be fixed before code can be generated, or the model code can be updated during the code engineering process. Warnings can generally be deferred until later. Errors and warnings are generated by the syntax checker, the compiler for the specific language, the UModel parser that reads the newly generated source file, as well as during the import of XMI files.

Generate documentation
Allows you to generate documenation for the currently open project in HTML, Microsoft Word, and RTF formats (see Generating UML documentation).

List Elements not used in any Diagram
Creates a list of all elements not used in any diagram in the project.

List shared Packages
Lists all shared packages of the current project.

List included Packages
Lists all include packages in the current project. Java Profile (Java Profile.ump) and Java Lang (Java Lang.ump) are automatically supplied in the Bankview example supplied with UModel.

14.4 Layout

The commands of the Layout menu allow you to line up and align the elements of your modeling diagrams.

When using the marquee (drag on the diagram background) to mark several elements, the element with the dashed outline becomes the "active" element, i.e. the last marked element. All alignment commands use this element as the origin, or basis for the following alignment commands.

Align:
The align command allows you to align modeling elements along their borders, or centers depending on the specific command you select.

Space evenly:
This set of commands allow you to space selected elements evenly both horizontally and vertically.

Make same size:
This set of commands allow you to adjust the width and height of selected elements based on the active element.

Line up:
This set of commands allow you to line up the selected elements vertically or horizontally.

Line Style:
This set of commands allow you to select the type of line used to connect the various modeling elements. The lines can be any type of dependency, association lines used in the various model diagrams.

Autosize:
This command resizes the selected elements to their respective optimal size(s).

Autolayout all:
This command allows you to choose the type of presentation of the modeling elements in the UML diagram tab.

"Force directed"
displays the modeling elements from a centric viewpoint.

"Hierarchic"
displays elements according to their relationships, superclass - derived class etc.

"**Block**"
displays elements grouped by element size in rectangular fashion.

Reposition text labels:
Repositions modeling element names (of the selected elements) to their default positions.

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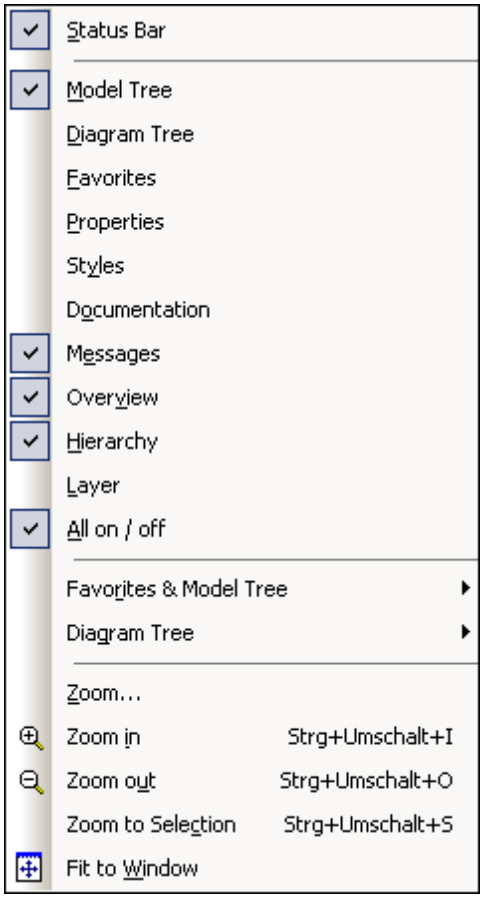
14.5 View

The commands available in this menu allow you to:

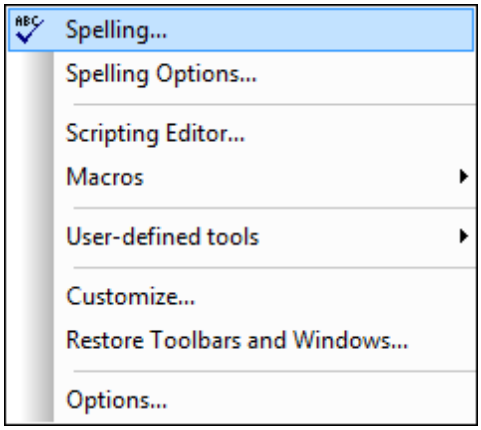
- **Switch**/activate tabs of the various panes
- Define the modeling element **sort criteria** of the Model Tree and Favorites tab
- Define the **grouping criteria** of the diagrams in the Diagram Tree tab
- Show or hide specific UML elements in the Favorites and Model Tree tab
- Define the **zoom** factor of the current diagram.



14.6 Tools

The tools menu allows you to:

- Customize your version: define your own toolbars, keyboard shortcuts, menus, and macros.
- Restore Toolbars and Windows to their default state.
- Define the global program settings/options.



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14.6.1 User-defined Tools

Placing the cursor over the **User-defined Tools** command rolls out a sub-menu containing custom-made commands that use external applications. You can create these commands in the Tools tab of the Customize dialog. Clicking one of these custom commands executes the action associated with this command.

The **User-Defined Tools | Customize** command opens the Tools tab of the Customize dialog (in which you can create the custom commands that appear in the menu of the **User-Defined Tools** command.)

14.6.2 Customize...

The customize command lets you customize UModel to suit your personal needs.

Commands
Toolbars
Tools
Keyboard
Menu
Options

Commands

The Commands tab allows you customize your menus or toolbars.

To add a command to a toolbar or menu:

1. Open this dialog box using **Tools | Customize.**
2. Select the command category in the Categories list box. The commands available appear in the Commands list box.
3. Click on a command in the commands list box and drag "it" to an to an existing menu or toolbar.
4. An I-beam appears when you place the cursor over a valid position to drop the command.
5. Release the mouse button at the position you want to insert the command.

- A small button appears at the tip of mouse pointer when you drag a command. The check mark below the pointer means that the command cannot be dropped at the current cursor position.
- The check mark disappears whenever you can drop the command (over a tool bar or menu).
- Placing the cursor over a menu when dragging, opens it, allowing you to insert the command anywhere in the menu.
- Commands can be placed in menus or tool bars. If you created you own toolbar you can populate it with your own commands/icons.

Please note:

You can also edit the commands in the **context menus** (right click anywhere opens the context menu), using the same method. Click the Menu tab and then select the specific context menu available in the Context Menus combo box.

To delete a command or menu:

1. Open this dialog box using **Tools | Customize.**
2. Click on the menu entry or icon you want to delete, and drag with the mouse.
3. Release the mouse button whenever the check mark icon appears below the mouse pointer.
   The command, or menu item is deleted from the menu or tool bar.

Toolbars

The Toolbars tab allows you to activate or deactivate specific toolbars, as well as create your own specialized ones.

Toolbars contain symbols for the most frequently used menu commands. For each symbol you get a brief "tool tip" explanation when the mouse cursor is directly over the item and the status bar shows a more detailed description of the command.

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You can drag the toolbars from their standard position to any location on the screen, where they appear as a floating window. Alternatively you can also dock them to the left or right edge of the main window.

To activate or deactivate a toolbar:

1. Click the check box to activate (or deactivate) the specific toolbar.

To create a new toolbar:

1. Click the **New...** button, and give the toolbar a name in the Toolbar name dialog box.
2. Add commands to the toolbar using the Commands tab of the Customize dialog box.

To reset the Menu Bar

- Click the Menu Bar entry and
- Click the **Reset** button, to reset the menu commands to the state they were when installed.

To reset all toolbar and menu commands

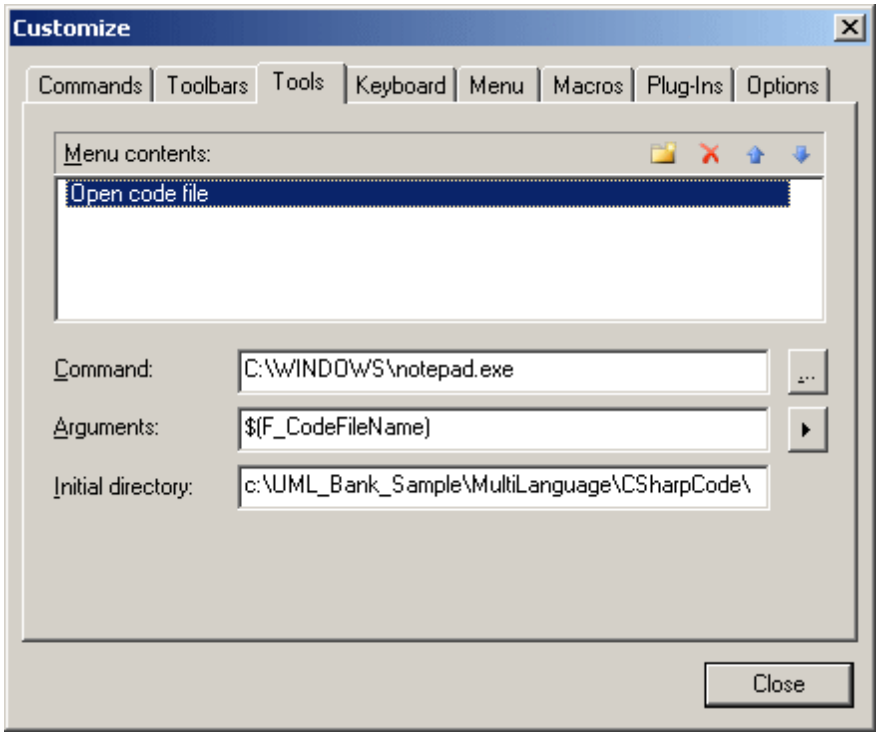
- Click the **Reset All** button, to reset all the toolbar commands to the state they were when the program was installed. A prompt appears stating that all toolbars and menus will be reset.
- Click Yes to confirm the reset.

Show text labels:
This option places explanatory text below toolbar icons when activated.

Tools

The Tools tab allows you to create your own menu **entries,** and associated arguments, to start external tools from within UModel via the Tools menu.

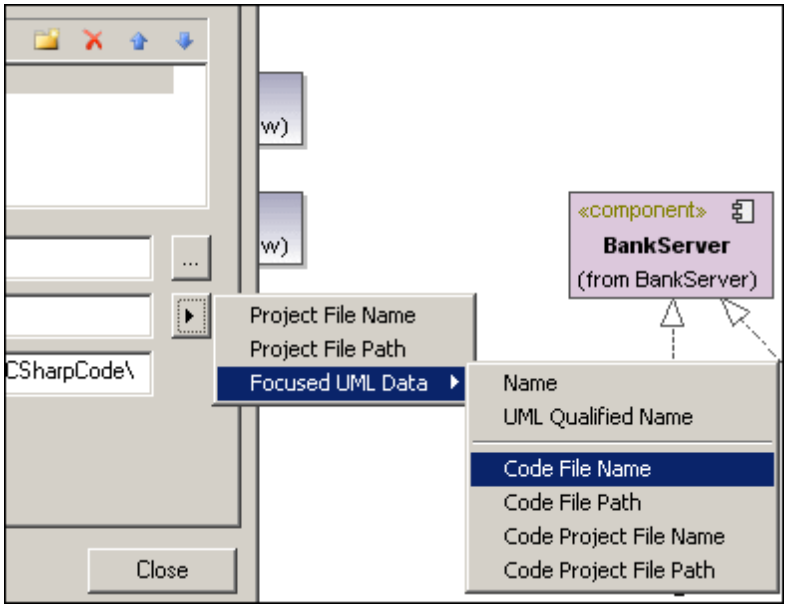
Click the folder icon (in the Menu contents: bar) to add a new menu entry, and use the Command field to associate it to an application.



The Tools tab now also supports the definition of **Arguments**. Arguments are variables that are assigned specific values when the external tool is started using the menu item.

E.g. Open the source code file of the currently selected UML class in Notepad.

1. Select the menu item **Tools | Customize** and click the **Tools** tab.
2. Enter the name and path of the external application e.g. C:\...\notepad.exe.
3. Click the Flyout button of the Arguments field and select the argument you want to use, e.g. Code File Name.



4. Click the Close button to finish.

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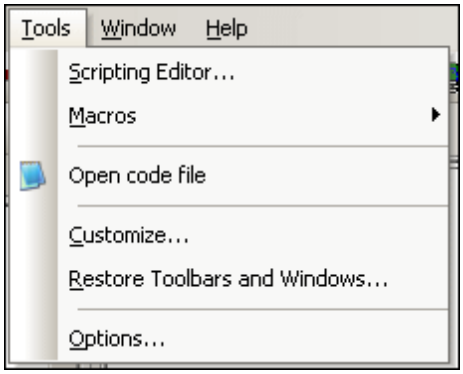
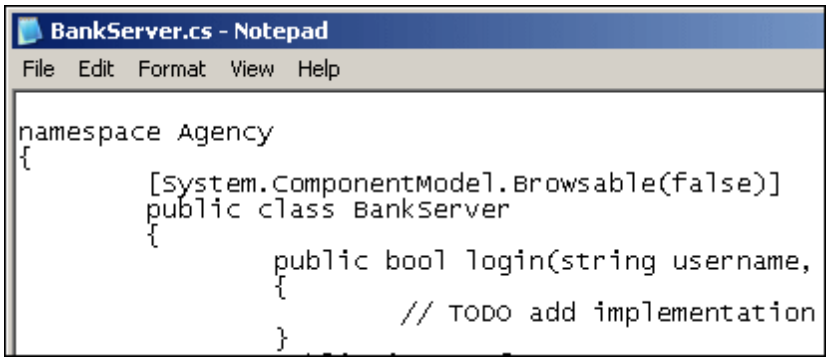
5. Click the Tools menu and select "Open code file".



The BankServer.cs file is opened in Notepad and is ready to be edited.



UModel Arguments

Project File Name
The file name of the active UModel project file, e.g. “Test.ump”.

Project File Path
The absolute file path of the active UModel project file, e.g. “c:\MyDirectory\Test.ump”.

Focused UML Data – Name
The name of the currently focused UML element, e.g. “Class1”.

Focused UML Data – UML Qualified Name
The qualified name of the currently focused UML element, e.g. “Package1::Package2::Class1”.

Focused UML Data – Code File Name
The code file name of the currently focused UML class, interface or enumeration as shown in the Property window (relative to the realizing component), e.g. “Class1.cs” or “MyNamespace \Class1.Java”.

Focused UML Data – Code File Path
The code file path of the currently focused UML class, interface or enumeration as shown in the Property window, e.g. “C:\Temp\MySource\Class1.cs”.

Focused UML Data – Code Project File Name
The file name of the code project the currently focused UML class, interface or enumeration

belongs to.

The code project file name can be relative to the UModel project file and is the same as shown in the Properties of the component, e.g. “C:\Temp\MySource\MyProject.vcproj” or “MySource \MyProject.vcproj”.

Focused UML Data – Code Project File Path

The file path of the code project the currently focused UML class, interface or enumeration belongs to, e.g. “C:\Temp\MySource\MyProject.vcproj”.

Keyboard

The Keyboard tab allows you to define (or change) keyboard shortcuts for any command.

To assign a new Shortcut to a command:

1. Select the commands category using the **Category** combo box.
2. Select the **command** you want to assign a new shortcut to, in the Commands list box
3. Click in the "**Press New Shortcut Key**:" text box, and press the shortcut keys that are to activate the command.
   The shortcuts appear immediately in the text box. If the shortcut was assigned previously, then that function is displayed below the text box.
4. Click the **Assign** button to permanently assign the shortcut.
   The shortcut now appears in the Current Keys list box.
   (To **clear** this text box, press any of the control keys, CTRL, ALT or SHIFT).

To de-assign (or delete a shortcut):

1. Click the shortcut you want to delete in the Current Keys list box, and
2. Click the **Remove** button (which has now become active).
3. Click the Close button to confirm all the changes made in the Customize dialog box.

Menu

The Menu tab allows you to customize the main menu bars as well as the (popup - right click) context menus.

You can customize both the Default and **UModel Project** menu bars.
The **Default** menu is the one visible when no XML documents of any type are open.
The **UModel Project** menu is the menu bar visible when a *.ump file has been opened.

To customize a menu:

1. Select the menu bar you want to customize from the "Show Menus for:" combo box
2. Click the **Commands** tab, and drag the commands to the menu bar of your choice.

To delete commands from a menu:

1. Click right on the command, or icon representing the command, and
2. Select the **Delete** option from the popup menu,

or,

1. Select **Tools | Customize** to open the Customize dialog box, and
2. Drag the command away from the menu, and drop it as soon as the check mark icon appears below the mouse pointer.

To reset either of the menu bars:

1. Select either the Default or UModel Project entry in the combo box, and

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2. Click the **Reset** button just below the menu name.
   A prompt appears asking if you are sure you want to reset the menu bar.

To customize any of the Context menus (right click menus):

1. Select the context menu from the "Select context menus" combo box.
2. Click the **Commands** tab, and drag the specific commands to context menu that is now open.

To delete commands from a context menu:

1. Click right on the command, or icon representing the command, and
2. Select the **Delete** option from the popup menu

or,

1. Select **Tools | Customize** to open the Customize dialog box, and
2. Drag the command away from the context menu, and drop it as soon as the check mark icon appears below the mouse pointer.

To reset any of the context menus:

1. Select the context menu from the combo box, and
2. Click the **Reset** button just below the context menu name.
   A prompt appears asking if you are sure you want to reset the context menu.

To close an context menu window:

1. Click on the **Close icon** at the top right of the title bar, or
2. Click the Close button of the Customize dialog box.

Menu shadows

- Click the Menu shadows check box, if you want all your menus to have shadows.

Options

The Options tab allows you to set general environment settings.

Toolbar

When active, the **Show ToolTips on toolbars** check box displays a popup when the mouse pointer is placed over an icon in any of the icon bars. The popup contains a short description of the icon function, as well as the associated keyboard shortcut, if one has been assigned.

The **Show shortcut keys in ToolTips** check box, allows you to decide if you want to have the shortcut displayed in the tooltip.

When active, the **Large icons** check box switches between the standard size icons, and larger versions of the icons.

14.6.3 Restore Toolbars and Windows

The **Restore Toolbars and Windows** command closes down UModel and re-starts it with the default settings. Before it closes down a dialog pops up asking for confirmation about whether UModel should be restarted.

This command is useful if you have been resizing, moving, or hiding toolbars or windows, and would now like to have all the toolbars and windows as they originally were.

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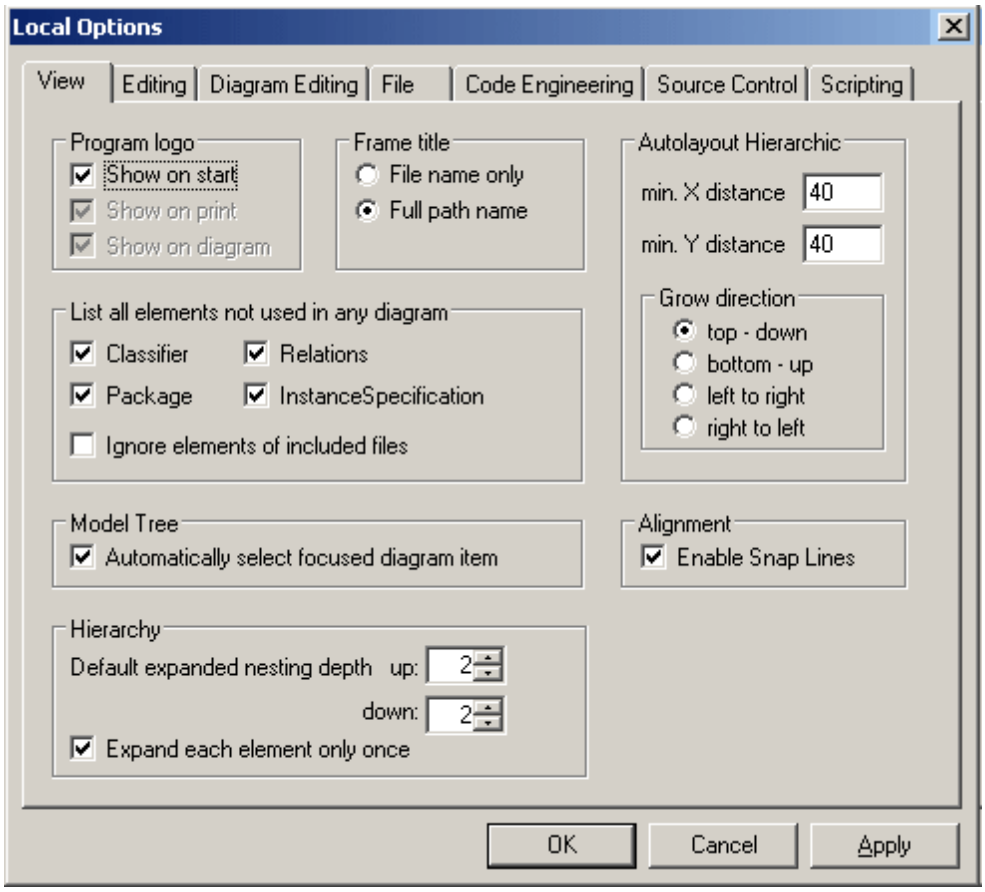
14.6.4 Options

Select the menu item **Tools | Options** to define your project options.

The **View** tab allows you to define:

- Where the program logo should appear.
- The application title bar contents.
- The types of elements you want listed when using the "List elements not used in any diagram" context menu option in the Model Tree, or Favorites tab. You also have the option of ignoring elements contained in **included** files.
- If a selected element in a diagram is automatically selected/synchronized in the Model Tree.
- The default depth of the hierarchy view when using the **Show graph view** in the Hierarchy tab.
- The Autolayout Hierarchic settings, which allow you to define the nesting depth up and down in the hierarchy window.
- "Expand each element only once", only allows one of the same classifiers to be expanded in the same image/diagram.
- If you want snap lines to help you align elements when dragging in a diagram.

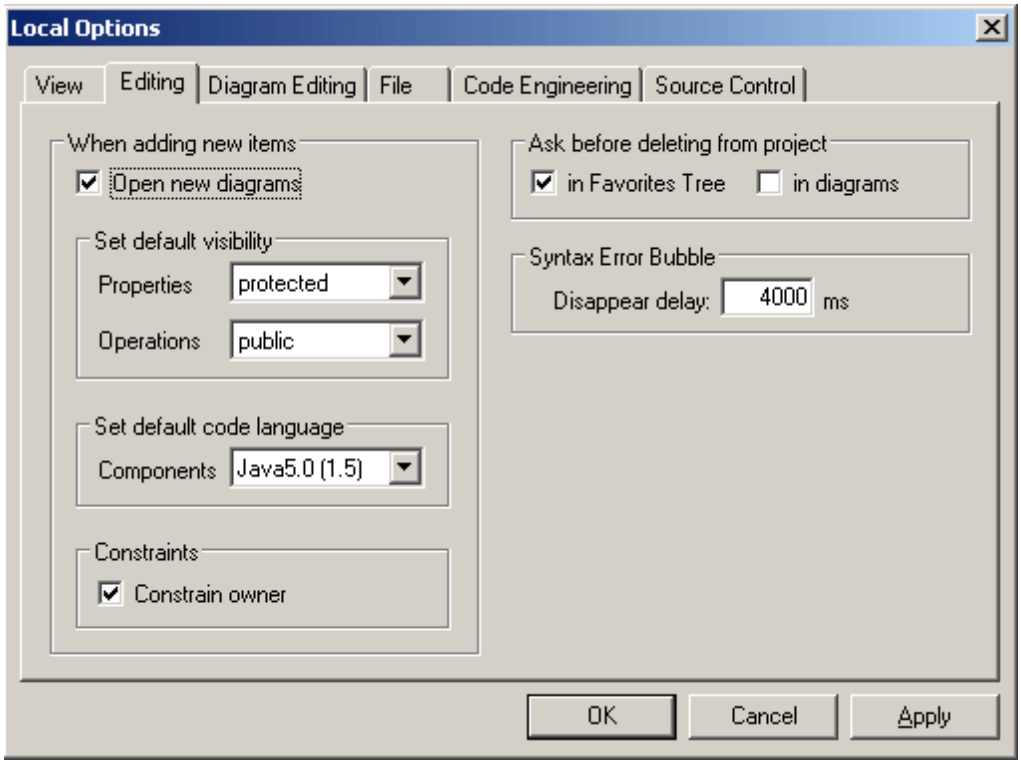


The **Editing** tab allows you to define:

- If a new Diagram created in the Model Tree tab, is also automatically opened in the main

area.

- Default visibility settings when adding new elements - Properites or Operations.
- The default code language when a new component is added.
- If a newly added constraint, is to automatically constrain its owner as well.
- If a prompt should appear when **deleting** elements from a project, from the Favorites tab or in any of the diagrams. This prompt can be deactivated when deleting items there; this option allows you to reset the "prompt on delete" dialog box.
- The delay with which the syntax error popup should be closed.



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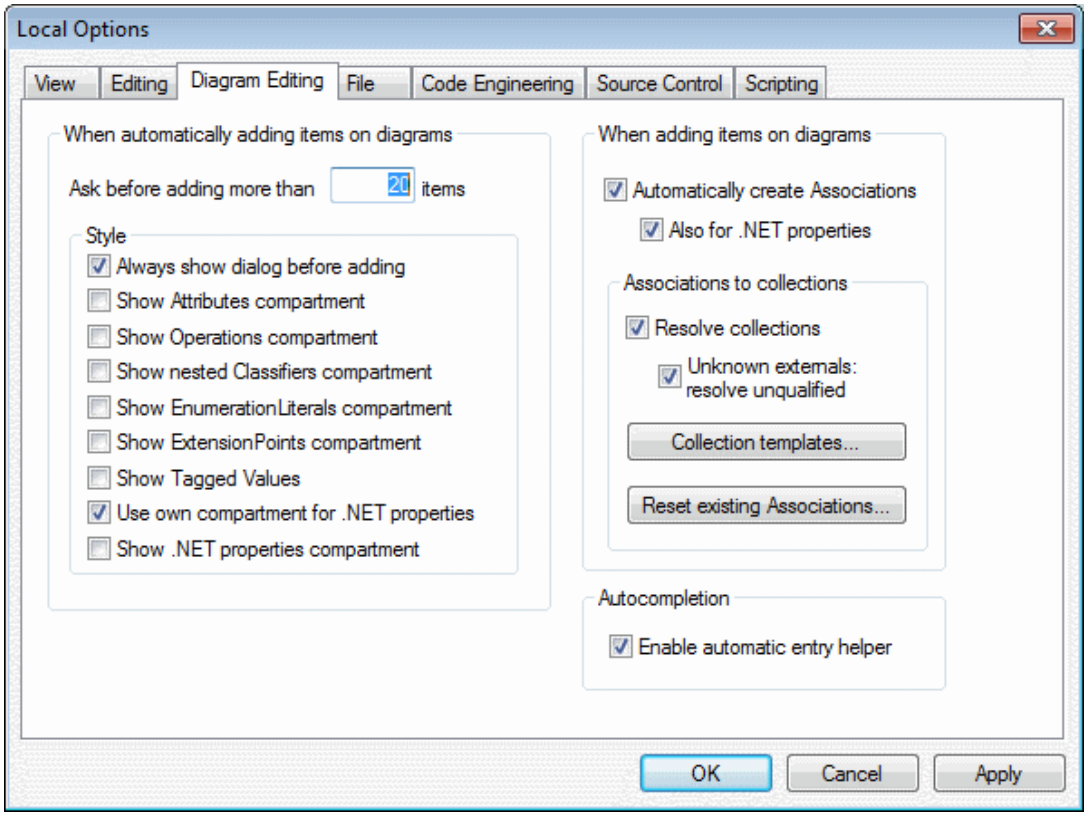
The **Diagram Editing** tab allows you to define:

- The number of items that can be automatically added to a diagram, before a prompt appears.
- The display of Styles when they are automatically added to a diagram.
- If Associations between modeling elements, are to be created automatically when items are added to a diagram.
- If the associations to collections are to be resolved.
- If templates from unknown externals are to be resolved as not fully qualified.
- or use preexisting Collection Templates, or define new ones.

  Collection Templates should be defined as fully qualified i.e. a.b.c.List. If the template has this namespace then UModel automatically creates a Collection Association. Exception: If the template belongs to the Unknown Externals package, and the option "Unknown externals: resolve unqualified", is enabled, then only the template name is considered (i.e. List instead of a.b.c.List).

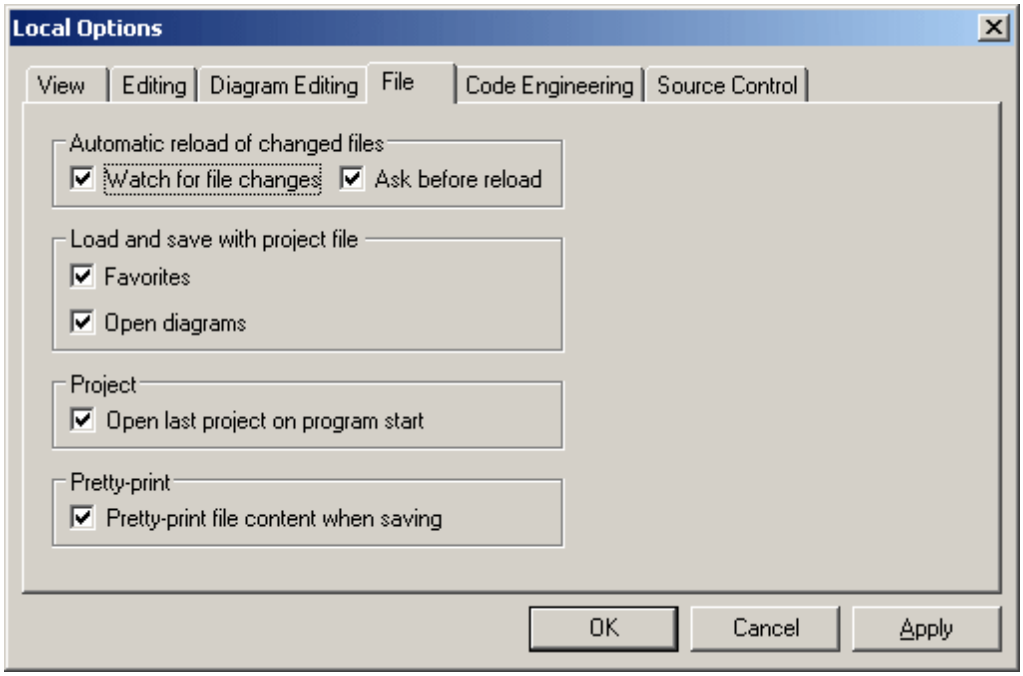
- If the autocompletion window is to be available when editing attributes or operations in the class diagram.



The **File** tab allows you to define:

- The actions performed when files are changed.
- If the contents of the Favorites tab are to be loaded and saved with the current project, as well as the any currently open diagrams.
- If the previously opened project is to automatically be opened when starting the application.
- If you want to structure the project file with CR/LF and tab indents in a **pretty-print**

format.



The **Code Engineering** tab allows you to define:

- The circumstances under which the Message window will open.
- If **all coding elements** i.e. those contained in a Java / C# / VB namespace root, as well as those assigned to a Java / C# / VB component, are to be checked, or

  only **elements used for code engineering**, i.e. where "use for code engineering" check box is active, are to be checked.
- When updating program code if:
  If a syntax check is to be performed.
  If missing ComponentRealizations are to be automatically generated.
  If missing code file names in the merged code are to be generated.
  If namespaces are to be used in the code file path.
- The Indentation method used in the code, i.e. tabs or any number of spaces.
- The directories to be ignored when updating a UModel project from code, or directory. Separate the respective directories with a semicolon "**;**". Child directories of the same name are also ignored.
- The location of the XMLSpy Catalog File, **RootCatalog.xml**, which enables UModel as well as XMLSpy to retrieve commonly used schemas (as well as stylesheets and other files) from local user folders. This increases the overall processing speed, and enables users to work offline.

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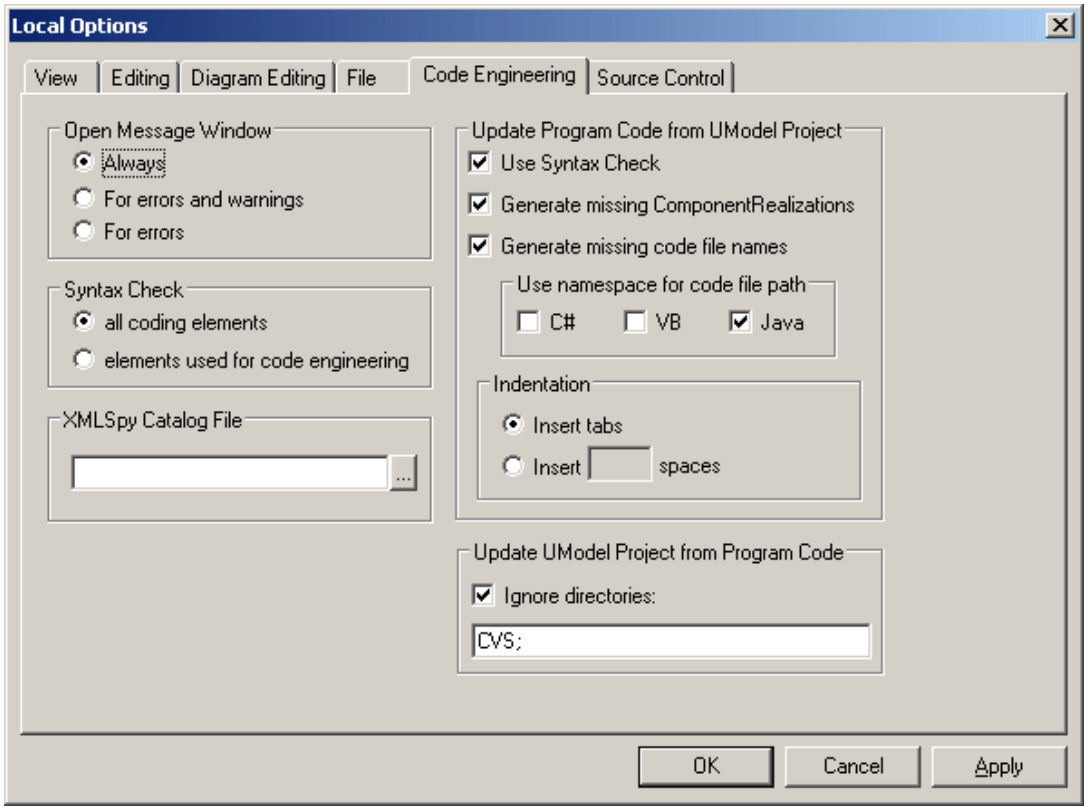
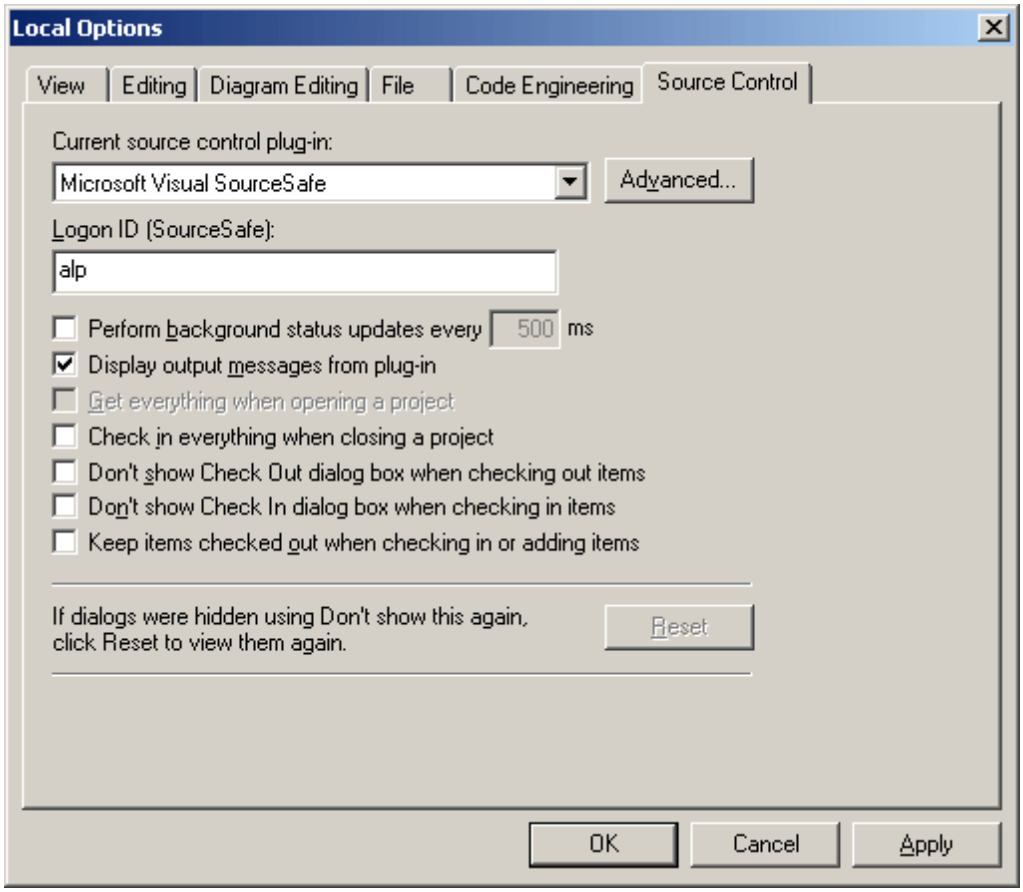

Local Options
View
Editing
Diagram Editing
File
Code Engineering
Source Control
Open Message Window
Always
For errors and warnings
For errors
Syntax Check
all coding elements
elements used for code engineering
XMLSpy Catalog File
...
Update Program Code from UModel Project
Use Syntax Check
Generate missing ComponentRealizations
Generate missing code file names
Use namespace for code file path
C#
VB
Java
Indentation
Insert tabs
Insert
spaces
Update UModel Project from Program Code
Ignore directories:
CVS;
OK
Cancel
Apply

The **Source Control** tab allows you to define:

- The current source control plugin using the combo box. The Advanced button allows you to define the specific settings of the source control plugin-that you selected. These settings change depending on the source control plugin that you use.
- The login ID for the source control provider.
- Specific settings check in/out settings.
- The Reset button is made available if you have checked/activated the "Don't show this again" option in one of the dialog boxes. The Don't show this again prompt is then reenabled.



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14.7 Window

Cascade:
This command rearranges all open document windows so that they are all cascaded (i.e. staggered) on top of each other.

Tile horizontally:
This command rearranges all open document windows as **horizontal tiles**, making them all visible at the same time.

Tile vertically:
This command rearranges all open document windows as **vertical tiles**, making them all visible at the same time.

Arrange icons:
Arranges haphazardly positioned, iconized diagrams, along the base of the diagram viewing area.

Close:
Closes the currently active diagram tab.

Close All:
Closes all currently open diagram tabs.

Close All but Active:
Closes all diagram tabs except for the currently active one.

Next:
Switches to the next modeling diagram in the tab sequence, or the next hyperlinked element.

Previous:
Switches to the previous modeling diagram in the tab sequence, or the previous hyperlinked element.

Window list:
This list shows all currently open windows, and lets you quickly switch between them.

You can also use the CTRL+TAB or CTRL F6 keyboard shortcuts to cycle through the open windows.

14.8 Help

Allows access to the Table of Contents and Index of the UModel documentation, as well as Altova web site links. The Registration option opens the Altova Licensing Manager, which contains the licensing information for all of Altova products.

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Chapter 15

Code Generator

15 Code Generator

UModel includes a built-in code generator which can automatically generate Java, C#, Visual Basic, or XML Schema files from UML models.

Note on **alias** usage:
When reverse engineering code which contains namespace or class aliases, you can now choose if the alias is to be resolved. (Check box "Resolve aliases" in Import Source Project/Directory dialog box).

When updating code, i.e. model to code, alias definitions are retained in the code as is. The scope of the alias definitions are the files in which they appear.

e.g.

```
using Q = System.Collections.Generic.Queue<String>;
Q myQueue;
```

Any potentially conflicting aliases are added to the "Unknown Externals" if their use is unclear.

Note:
The Resolve alias settings can be changed at any time in the Project Settings dialog box.

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15.1 The way to SPL (Spy Programming Language)

This section gives an overview of Spy Programming Language, the code generator's template language.

It is assumed that you have prior programming experience, and are familiar with operators, functions, variables and classes, as well as the basics of object-oriented programming - which is used heavily in SPL.

The templates used by UModel are supplied in the ...\UModelspl folder. You can use these files as an aid to help you in developing your own templates.

How code generator works

Inputs to the code generator are the template files (.spl) and the object model provided by UModel. The template files contain SPL instructions for creating files, reading information from the object model and performing calculations, interspersed with literal code fragments in the target programming language.

The template file is interpreted by the code generator and outputs **.java, .cs** source code files, , or any other type of file depending on the template.

15.1.1 Basic SPL structure

An SPL file contains literal text to output, interspersed with code generator instructions.

Code generator instructions are enclosed in square brackets '**[**' and '**]**'.
Multiple statements can be included in a bracket pair. Additional statements have to be separated by a new line or a colon '**:**'.

Valid examples are:

```
[$x = 42
$x = $x + 1]
```

or

```
[$x = 42: $x = $x + 1]
```

Adding text to files

Text not enclosed by **[** and **]**, is written directly to the current output file.
To output literal square brackets, escape them with a backslash: **\[** and **\]**; to output a backslash use ****.

Comments

Comments inside an instruction block always begin with a **'** character, and terminate on the next line, or at a block close character **]**.

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15.1.2 Variables

Any non-trivial SPL file will require variables. Some variables are predefined by the code generator, and new variables may be created simply by assigning values to them.

The **$** character is used when **declaring** or **using** a variable, a variable name is always prefixed by **$**.
Variable names are **case sensitive**.

Variables types:

- integer - also used as boolean, where 0 is false and everything else is true
- string
- object - provided by UModel
- iterator - see foreach statement

Variable types are declared by first assignment:

```
[$x = 0]
```

x is now an integer.

```
[$x = "teststring"]
```

x is now treated as a string.

Strings

String constants are always enclosed in double quotes, like in the example above. **\n** and **\t** inside double quotes are interpreted as newline and tab, **\"** is a literal double quote, and \\ is a backslash. String constants can also span multiple lines.

String concatenation uses the **&** character:

```
[$BasePath = $outputpath & "/" & $JavaPackageDir]
```

Objects

Objects represent the information contained in the UModelproject. Objects have **properties**, which can be accessed using the **.** operator. It is not possible to create new objects in SPL (they are predefined by the code generator, derived from the input), but it is possible to assign objects to variables.

Example:

```
class [=$class.Name]
```

This example outputs the word "class", followed by a space and the value of the **Name** property of the **$class** object.

The following table show the relationship between UML elements their SPL equivalents along with a short description.

Predefined variables

UML element	SPL property	Multiplicity	UML	UModel	Description

			Attribute / Association	Attribute / Association	
BehavioralFeature	isAbstract		isAbstract:Boolean		
BehavioralFeature	raisedException	*	raisedException:Type		
BehavioralFeature	ownedParameter	*	ownedParameter:Parameter		
BehavioredClassifier	interfaceRealization	*	interfaceRealization:InterfaceRealization		
Class	ownedOperation	*	ownedOperation:Operation		
Class	nestedClassifier	*	nestedClassifier:Classifier		
Classifier	namespace	*		namespace:Package	packages with code language <<namespace>> set
Classifier	rootNamespace	*		project root namespace:String	VB only - root namespace
Classifier	generalization	*	generalization:Generalization		
Classifier	isAbstract		isAbstract:Boolean		
ClassifierTemplateParameter	constrainingClassifier	*	constrainingClassifier		
Comment	body		body:String		
DataType	ownedAttribute	*	ownedAttribute:Property		
DataType	ownedOperation	*	ownedOperation:Operation		
Element	kind			kind:String	
Element	owner	0..1	owner:Element		
Element	appliedStereotype	*		appliedStereotype:StereotypeApplication	applied stereotypes
Element	ownedComment	*	ownedComment:Comment		
ElementImport	importedElement	1	importedElement:PackageableElement		
Enumeration	ownedLiteral	*	ownedLiteral:EnumerationLiteral		

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Enumeration	nestedClassifier	*		nestedClassifier::Classifier	
Enumeration	interfaceRealization	*		interfaceRealization:Interface	
EnumerationLiteral	ownedAttribute	*		ownedAttribute:Property	
EnumerationLiteral	ownedOperation	*		ownedOperation:Operation	
EnumerationLiteral	nestedClassifier	*		nestedClassifier:Classifier	
Feature	isStatic		isStatic:Boolean		
Generalization	general	1	general:Classifier		
Interface	ownedAttribute	*	ownedAttribute:Property		
Interface	ownedOperation	*	ownedOperation:Operation		
Interface	nestedClassifier	*	nestedClassifier:Classifier		
InterfaceRealization	contract	1	contract:Interface		
MultiplicityElement	lowerValue	0..1	lowerValue:ValueSpecification		
MultiplicityElement	upperValue	0..1	upperValue:ValueSpecification		
NamedElement	name		name:String		
NamedElement	visibility		visibility:VisibilityKind		
NamedElement	isPublic			isPublic:Boolean	visibility <public>
NamedElement	isProtected			isProtected:Boolean	visibility <protected>
NamedElement	isPrivate			isPrivate:Boolean	visibility <private>
NamedElement	isPackage			isPackage:Boolean	visibility <package>
NamedElement	namespacePrefix			namespacePrefix:String	XSD only - namespace prefix when exists
NamedElement	parseableName			parseableName:String	CSharp, VB only - name with escaped keywords (@)

Namespace	elementImport	*	elementImport:ElementImport		
Operation	ownedReturnParameter	0..1		ownedReturnParameter:Parameter	parameter with direction return set
Operation	type	0..1		type	type of parameter with direction return set
Operation	ownedOperationParameter	*		ownedOperationParameter:Parameter	all parameters excluding parameter with direction return set
Operation	implementedInterface	1		implementedInterface:Interface	CSharp only - the implemented interface
Operation	ownedOperationImplementations	*		implementedOperation:OperationImplementation	VB only - the implemented interfaces/operations
OperationImplementation	implementedOperationOwner	1		implementedOperationOwner:Interface	interface implemented by the operation
OperationImplementation	implementedOperationName			name:String	name of the implemented operation
OperationImplementation	implementedOperationParseableName			parseableName:String	name of the implemented operation with esacped keywords
Package	namespace	*		namespace:Package	packages with code language <<namespace>> set
PackageableElement	owningPackage	0..1		owningPackage	set if owner is a package
PackageableElement	owningNamespacePackage	0..1		owningNamespacePackage:Package	owning package with code language <<namespace>> set
Parameter	direction		direction:ParameterDirectionKind		
Parameter	isIn			isIn:Boolean	direction <in>
Parameter	isInOut			isInOut:Boolean	direction <inout>
Parameter	isOut			isOut:Boolean	direction <out>
Parameter	isReturn			isReturn:Boolean	direction <return>
Parameter	isVarArgList			isVarArgList:Boolean	true if parameter is a variable argument list

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Parameter	defaultValue	0..1	defaultValue:ValueSpecification		
Property	defaultValue	0..1	defaultValue:ValueSpecification		
RedefinableElement	isLeaf		isLeaf:Boolean		
Slot	name			name:String	name of the defining feature
Slot	values	*	value:ValueSpecification		
Slot	value			value:String	value of the first value specification
StereotypeApplication	name			name:String	name of applied stereotype
StereotypeApplication	taggedValue	*		taggedValue:Slot	first slot of the instance specification
StructuralFeature	isReadOnly		isReadOnly		
StructuredClassifier	ownedAttribute	*	ownedAttribute:Property		
TemplateBinding	signature	1	signature:TemplateSignature		
TemplateBinding	parameterSubstitution	*	parameterSubstitution:TemplateParameterSubstitution		
TemplateParameter	paramDefault			paramDefault:String	template parameter default value
TemplateParameter	ownedParameteredElement	1	ownedParameteredElement:ParameterableElement		
TemplateParameterSubstitution	parameterSubstitution			parameterSubstitution:String	Java only - code wildcard handling
TemplateParameterSubstitution	parameterDimensionCount			parameterDimensionCount:Integer	code dimension count of the actual parameter
TemplateParameterSubstitution	actual	1	OwnedActual:ParameterableElement		
TemplateParameterSubstitution	formal	1	formal:TemplateParameter		
TemplateSignature	template	1	template:TemplateableElement		
TemplateSignature	ownedParameter	*	ownedParameter:TemplateParameter		

TemplateableElement	isTemplate			isTemplate:Boolean	true if template signature set
TemplateableElement	ownedTemplateSignature	0..1	ownedTemplateSignature:TemplateSignature		
TemplateableElement	templateBinding	*	templateBinding:TemplateBinding		
Type	typeName	*		typeName:PackageableElement	qualified code type names
TypedElement	type	0..1	type:Type		
TypedElement	postTypeModifier			postTypeModifier:String	postfix code modifiers
ValueSpecification	value			value:String	string value of the value specification

Adding a prefix to attributes of a class during code generation

You might need to prefix all new attributes with the "m_" characters in your project.

All new coding elements are written using the SPL templates:
If you look into UModelSPL\C#[Java]**Default\Attribute.spl**, you can change the way how the name is written, e.g. replace

write $Property.name

by

write **"m_"** & $Property.name

It is highly recommended that you immediately update your model from code, after code generation to ensure that code and model are synchronized!

Please note:
As previously mentioned copy the SPL templates one directory higher (i.e. above the **default** directory to UModelSPL\C#) before modifying them. This ensures that they are not overwritten when you install a new version of UModel. Please make sure that the "user-defined override default" check box is activated in the **Code from Model** tab of the Synchronization Setting dialog box.

SPL Templates

SPL templates can be specified per UModel project using the menu option **Project | Project Settings** (as shown in the screenshot below). Relative paths are also supported. Templates which are not found in the specified directory, are searched for in the local default directory.

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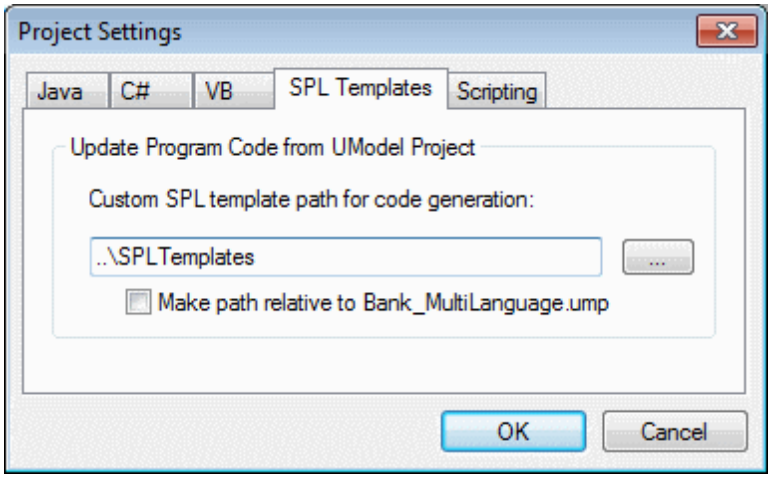

Global objects

$Options	an object holding global options:
	generateComments:bool generate doc comments (true/false)
$Indent	a string used to indent generated code and represent the current nesting level
$IndentStep	a string, used to indent generated code and represent one nesting level
$NamespacePrefix	XSD only – the target namespace prefix if present

String manipulation routines

integer **Compare**(s)
The return value indicates the lexicographic relation of the string to s (case sensitive):

<0:	the string is less than s
0:	the string is identical to s
>0:	the string is greater than s

integer **CompareNoCase**(s)
The return value indicates the lexicographic relation of the string to s (case insensitive):

<0:	the string is less than s
0:	the string is identical to s
>0:	the string is greater than s

integer **Find**(s)
Searches the string for the first match of a substring s.
Returns the zero-based index of the first character of s or -1 if s is not found.

string **Left**(n)
Returns the first n characters of the string.

integer **Length**()
Returns the length of the string.

string **MakeUpper**()
Returns a string converted to upper case.

string **MakeUpper**(n)
Returns a string, with the first n characters converted to upper case.

string **MakeLower**()
Returns a string converted to lower case.

string **MakeLower**(n)
Returns a string, with the first n characters converted to lower case.

string **Mid**(n)
Returns a string starting with the zero-based index position n

string **Mid**(n, m)
Returns a string starting with the zero-based index position n and the length m

string **RemoveLeft**(s)
Returns a string excluding the substring s if Left(s.Length()) is equal to substring s.

string **RemoveLeftNoCase**(s)
Returns a string excluding the substring s if Left(s.Length()) is equal to substring s (case insensitive).

string **RemoveRight**(s)
Returns a string excluding the substring s if Right(s.Length()) is equal to substring s.

string **RemoveRightNoCase**(s)
Returns a string excluding the substring s if Right(s.Length()) is equal to substring s (case insensitive).

string **Repeat**(s, n)
Returns a string containing substring s repeated n times.

string **Right**(n)
Returns the last n characters of the string.

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15.1.3 Operators

Operators in SPL work like in most other programming languages.

List of SPL operators in descending precedence order:

.	Access object property
( )	Expression grouping
true	boolean constant "true"
false	boolean constant "false"
&	String concatenation
-	Sign for negative number
not	Logical negation
*	Multiply
/	Divide
%	Modulo
+	Add
-	Subtract
<=	Less than or equal
<	Less than
>=	Greater than or equal
>	Greater than
=	Equal
<>	Not equal
and	Logical conjunction (with short circuit evaluation)
or	Logical disjunction (with short circuit evaluation)
=	Assignment

15.1.4 Conditions

SPL allows you to use standard "if" statements. The syntax is as follows:

```
if condition
       statements
else
       statements
endif
```

or, without else:

```
if condition
       statements
endif
```

Please note that there are no round brackets enclosing the condition!
As in any other programming language, conditions are constructed with logical and comparison operators.

Example:

```
[if $namespace.ContainsPublicClasses and $namespace.Prefix <> ""]
       whatever you want ['inserts whatever you want, in the resulting file]
[endif]
```

Switch

SPL also contains a multiple choice statement.

Syntax:

```
switch $variable
       case X:
              statements
       case Y:
       case Z:
              statements
       default:
              statements
endswitch
```

The case labels must be constants or variables.

The switch statement in SPL does not fall through the cases (as in C), so there is no need for a "break" statement.

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15.1.5 Collections and foreach

Collections and iterators

A collection contains multiple objects - like a ordinary array. Iterators solve the problem of storing and incrementing array indexes when accessing objects.

Syntax:

```
foreach iterator in collection
       statements
next
```

Example:

```
[foreach $class in $classes
       if not $class.IsInternal
              ]      class [=$class.Name];
[      endif
next]
```

Example 2:

```
[foreach $i in 1 To 3
      Write "// Step " & $i & "\n"
      ' Do some work
next]
```

Foreach steps through all the items in $classes, and executes the code following the instruction, up to the **next** statement, for each of them.

In each iteration, **$class** is assigned to the next class object. You simply work with the class object instead of using, classes[i]->Name(), as you would in C++.

All collection iterators have the following additional properties:

Index	The current index, starting with 0
IsFirst	true if the current object is the first of the collection (index is 0)
IsLast	true if the current object is the last of the collection

Example:

```
[foreach $enum in $facet.Enumeration
       if not $enum.IsFirst
              ], [
       endif
       ]"[=$enum.Value]"[
next]
```

Collection manipulation routines:

collection **SortByName**(bAscending)
returns a collection whose elements are sorted by name (case sensitive) in ascending or descending order.

collection **SortByNameNoCase**(bAscending)
returns a collection whose elements are sorted by name (case insensitive) in ascending or descending order

Example:
```
$SortedNestedClassifier = $Class.nestedClassifier.SortByNameNoCase( true )
```

collection **SortByKind**(bAscending)
returns a collection whose elements are sorted by kind names (e.g. “Class”, “Interface”,…) in ascending or descending order.

collection **SortByKindAndName**(bAscendingKind, bAscendingName)
returns a collection whose elements are sorted by kind (e.g. “Class”, “Interface”,…) in ascending or descending order and if the kinds are equal by name (case sensitive in ascending or descending order)

collection **SortByKindAndNameNoCase**(bAscending)
returns a collection whose elements are sorted by kind (e.g. “Class”, “Interface”,…) in ascending or descending order and if the kinds are equal by name (case insensitive in ascending or descending order)

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15.1.6 Subroutines

Code generator supports subroutines in the form of procedures or functions.

Features:

- By-value and by-reference passing of values
- Local/global parameters (local within subroutines)
- Local variables
- Recursive invocation (subroutines may call themselves)

Subroutine declaration

Subroutines

Syntax example:

```
Sub SimpleSub()

... lines of code

EndSub
```

- **Sub** is the keyword that denotes the procedure.
- **SimpleSub** is the name assigned to the subroutine.
- Round **parenthesis** can contain a parameter list.
- The code block of a subroutine starts immediately after the closing parameter parenthesis.
- **EndSub** denotes the end of the code block.

Please note:
Recursive or cascaded subroutine **declaration** is not permitted, i.e. a subroutine may not contain another subroutine.

Parameters
Parameters can also be passed by procedures using the following syntax:

- All parameters must be variables
- Variables must be prefixed by the **$** character
- Local variables are defined in a subroutine
- Global variables are declared explicitly, outside of subroutines
- Multiple parameters are separated by the comma character "**,**" within round parentheses
- Parameters can pass values

Parameters - passing values
Parameters can be passed in two ways, by value and by reference, using the keywords **ByVal** and **ByRef** respectively.

Syntax:

```
' define sub CompleteSub()
[Sub CompleteSub( $param, ByVal $paramByValue, ByRef $paramByRef )
] ...
```

- **ByVal** specifies that the parameter is passed by value. Note that most objects can only be passed by reference.

- **ByRef** specifies that the parameter is passed by reference. This is the default if neither ByVal nor ByRef is specified.

Function return values

To return a value from a subroutine, use the **return** statement. Such a function can be called from within an expression.

Example:

```
' define a function
[Sub MakeQualifiedName( ByVal $namespacePrefix, ByVal $localName )
if $namespacePrefix = ""
  return $localName
else
  return $namespacePrefix & ":" & $localName
endif
EndSub
]
```

Subroutine invocation

Use **call** to invoke a subroutine, followed by the procedure name and parameters, if any.

```
Call SimpleSub()
```

or,

```
Call CompleteSub( "FirstParameter", $ParamByValue, $ParamByRef )
```

Function invocation

To invoke a function (any subroutine that contains a **return** statement), simply use its name inside an expression. Do not use the **call** statement to call functions.
Example:

```
$QName = MakeQualifiedName($namespace, "entry")
```

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15.2 Error Codes

Operating System Error Codes

201 File not found: '%s'
202 Cannot create file '%s'
203 Cannot open file '%s'
204 Cannot copy file '%s' to '%s'

Syntax Error Codes

401 Keyword expected
402 '%s' expected
403 No output file specified
404 Unexpected end of file
405 Keyword not allowed

Runtime Error Codes

501 Unknown variable '%s'
502 Redefinition of variable '%s'
503 Variable '%s' is not a container
504 Unknown property '%s'
505 Cannot convert from %s to %s
507 Unknown function
508 Function already defined
509 Invalid parameter
510 Division by zero
511 Unknown method
512 Incorrect number of parameters
513 Stack overflow

Chapter 16

License Information

16 License Information

This section contains:

- Information about the distribution of this software product
- Information about software activation and license metering
- Information about the intellectual property rights related to this software product
- The End-User License Agreement governing the use of this software product

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against you (or payable by you pursuant to a settlement agreement) in connection with a Claim to the extent such direct damages and costs are not reimbursed to you by insurance or a third party, to an aggregate maximum equal to the purchase price of the Software. If the Software or its use becomes the subject of a Claim or its use is enjoined, or if in the opinion of Altova's legal counsel the Software is likely to become the subject of a Claim, Altova shall attempt to resolve the Claim by using commercially reasonable efforts to modify the Software or obtain a license to continue using the Software. If in the opinion of Altova's legal counsel the Claim, the injunction or potential Claim cannot be resolved through reasonable modification or licensing, Altova, at its own election, may terminate this Agreement without penalty, and will refund to you on a pro rata basis any fees paid in advance by you to Altova. THE FOREGOING CONSTITUTES ALTOVA'S SOLE AND EXCLUSIVE LIABILITY FOR INTELLECTUAL PROPERTY INFRINGEMENT. This indemnity does not apply to situations where the alleged infringement, whether patent or otherwise, is the result of a combination of the Altova software and additional elements supplied by you.

6. SUPPORT AND MAINTENANCE

Altova offers multiple optional "Support & Maintenance Package(s)" ("SMP") for the version of Software product edition that you have licensed, which you may elect to purchase in addition to your Software license. The Support Period, hereinafter defined, covered by such SMP shall be delineated at such time as you elect to purchase a SMP. Your rights with respect to support and maintenance as well as your upgrade eligibility depend on your decision to purchase SMP and the level of SMP that you have purchased:

(a) If you have not purchased SMP, you will receive the Software AS IS and will not receive any maintenance releases or updates. However, Altova, at its option and in its sole discretion on a case by case basis, may decide to offer maintenance releases to you as a courtesy, but these maintenance releases will not include any new features in excess of the feature set at the time of your purchase of the Software. In addition, Altova will provide free technical support to you for thirty (30) days after the date of your purchase (the "Support Period" for the purposes of this paragraph 6(a), and Altova, in its sole discretion on a case by case basis, may also provide free courtesy technical support during your thirty (30) day evaluation period. Technical support is provided via a Web-based support form only, and there is no guaranteed response time.

(b) If you have purchased SMP, then solely for the duration of its delineated Support Period, **you are eligible to receive the version of the Software edition** that you have licensed and all maintenance releases and updates for that edition that are released during your Support Period. For the duration of your SMP's Support Period, you will also be eligible to receive upgrades to the comparable edition of the next version of the Software that succeeds the Software edition that you have licensed for applicable upgrades released during your Support Period. The specific upgrade edition that you are eligible to receive based on your Support Period is further detailed in the SMP that you have purchased. Software that is introduced as separate product is not included in SMP. Maintenance releases, updates and upgrades may or may not include additional features. In addition, Altova will provide Priority Technical Support to you for the duration of the Support Period. Priority Technical Support is provided via a Web-based support form only and Altova will make commercially reasonable efforts to respond via e-mail to all requests within forty-eight (48) hours during Altova's business hours (MO-FR, 8am UTC – 10pm UTC, Austrian and US holidays excluded) and to make reasonable efforts to provide work-arounds to errors reported in the Software.

During the Support Period you may also report any Software problem or error to Altova. If Altova determines that a reported reproducible material error in the Software exists and significantly impairs the usability and utility of the Software, Altova agrees to use reasonable commercial efforts to correct or provide a usable work-around solution in an upcoming maintenance release or

update, which is made available at certain times at Altova's sole discretion.

If Altova, in its discretion, requests written verification of an error or malfunction discovered by you or requests supporting example files that exhibit the Software problem, you shall promptly provide such verification or files, by email, telecopy, or overnight mail, setting forth in reasonable detail the respects in which the Software fails to perform. You shall use reasonable efforts to cooperate in diagnosis or study of errors. Altova may include error corrections in maintenance releases, updates, or new major releases of the Software. Altova is not obligated to fix errors that are immaterial. Immaterial errors are those that do not significantly impact use of the Software as determined by Altova in its sole discretion. Whether or not you have purchased the Support & Maintenance Package, technical support only covers issues or questions resulting directly out of the operation of the Software and Altova will not provide you with generic consultation, assistance, or advice under any circumstances.

Updating Software may require the updating of software not covered by this Agreement before installation. Updates of the operating system and application software not specifically covered by this Agreement are your responsibility and will not be provided by Altova under this Agreement. Altova's obligations under this Section 6 are contingent upon your proper use of the Software and your compliance with the terms and conditions of this Agreement at all times. Altova shall be under no obligation to provide the above technical support if, in Altova's opinion, the Software has failed due to the following conditions: (i) damage caused by the relocation of the Software to another location or CPU; (ii) alterations, modifications or attempts to change the Software without Altova's written approval; (iii) causes external to the Software, such as natural disasters, the failure or fluctuation of electrical power, or computer equipment failure; (iv) your failure to maintain the Software at Altova's specified release level; or (v) use of the Software with other software without Altova's prior written approval. It will be your sole responsibility to: (i) comply with all Altova-specified operating and troubleshooting procedures and then notify Altova immediately of Software malfunction and provide Altova with complete information thereof; (ii) provide for the security of your confidential information; (iii) establish and maintain backup systems and procedures necessary to reconstruct lost or altered files, data or programs.

7. SOFTWARE ACTIVATION, UPDATES AND LICENSE METERING

(a) License Metering. The Software includes a built-in license metering module that is designed to assist you with monitoring license compliance in small local area networks (LAN). The metering module attempts to communicate with other machines on your local area network (LAN). You permit Altova to use your internal network for license monitoring for this purpose. This license metering module may be used to assist with your license compliance but should not be the sole method. Should your firewall settings block said communications, you must deploy an accurate means of monitoring usage by the end user and preventing users from using the Software more than the Permitted Number.

(b) License Compliance Monitoring. You are required to utilize a process or tool to ensure that the Permitted Number is not exceeded. Without prejudice or waiver of any potential violations of the Agreement, Altova may provide you with additional compliance tools should you be unable to accurately account for license usage within your organization. If provided with such a tool by Altova, you (a) are required to use it in order to comply with the terms of this Agreement and (b) permit Altova to use your internal network for license monitoring and metering and to generate compliance reports that are communicated to Altova from time to time.

(c) Software Activation. **The Software may use your internal network and Internet connection for the purpose of transmitting license-related data at the time of installation, registration, use, or update to an Altova Master License Server and validating the**

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authenticity of the license-related data in order to protect Altova against unlicensed or illegal use of the Software and to improve customer service. Activation is based on the exchange of license related data between your computer and the Altova Master License Server. You agree that Altova may use these measures and you agree to follow any applicable requirements. You further agree that use of license key codes that are not or were not generated by Altova and lawfully obtained from Altova, or an authorized reseller as part of an effort to activate or use the Software violates Altova's intellectual property rights as well as the terms of this Agreement. You agree that efforts to circumvent or disable Altova's copyright protection mechanisms, the license management mechanism, or the Altova Master License Server violate Altova's intellectual property rights as well as the terms of this Agreement. Altova expressly reserves the rights to seek all available legal and equitable remedies to prevent such actions and to recover lost profits, damages and costs.

(d) LiveUpdate. Altova provides a new LiveUpdate notification service to you, which is free of charge. Altova may use your internal network and Internet connection for the purpose of transmitting license-related data to an Altova-operated LiveUpdate server to validate your license at appropriate intervals and determine if there is any update available for you.

(e) Use of Data. The terms and conditions of the Privacy Policy are set out in full at http://www.altova.com/privacy and are incorporated by reference into this Agreement. By your acceptance of the terms of this Agreement and/or use of the Software, you authorize the collection, use and disclosure of information collected by Altova for the purposes provided for in this Agreement and/or the Privacy Policy. Altova has the right in its sole discretion to amend this provision of the Agreement and/or Privacy Policy at any time. You are encouraged to review the terms of the Privacy Policy as posted on the Altova Web site from time to time.

(f) Audit Rights. You agree that Altova may audit your use of the Software for compliance with the terms of this Agreement at any time, upon reasonable notice. In the event that such audit reveals any use of the Software by you other than in full compliance with the terms of this Agreement, you shall reimburse Altova for all reasonable expenses related to such audit in addition to any other liabilities you may incur as a result of such non-compliance.

(g) Notice to European Users. Please note that the information as described in paragraph 7(d) above may be transferred outside of the European Economic Area, for purposes of processing, analysis, and review, by Altova, Inc., a company located in Beverly, Massachusetts, U.S.A., or its subsidiaries or Altova's subsidiaries or divisions, or authorized partners, located worldwide. You are advised that the United States uses a sectoral model of privacy protection that relies on a mix of legislation, governmental regulation, and self-regulation. You are further advised that the Council of the European Union has found that this model does not provide "adequate" privacy protections as contemplated by Article 25 of the European Union's Data Directive. (Directive 95/46/EC, 1995 O.J. (L 281) 31). Article 26 of the European Union's Data Directive allows for transfer of personal data from the European Union to a third country if the individual has unambiguously given his consent to the transfer of personal information, regardless of the third country's level of protection. By agreeing to this Agreement, you consent to the transfer of all such information to the United States and the processing of that information as described in this Agreement and the Privacy Policy.

8. TERM AND TERMINATION

This Agreement may be terminated (a) by your giving Altova written notice of termination; (b) by Altova, at its option, giving you written notice of termination if you commit a breach of this Agreement and fail to cure such breach within ten (10) days after notice from Altova; or (c) at the

request of an authorized Altova reseller in the event that you fail to make your license payment or other monies due and payable. In addition the Agreement governing your use of a previous version of the Software that you have upgraded or updated is terminated upon your acceptance of the terms and conditions of the Agreement accompanying such upgrade or update. Upon any termination of the Agreement, you must cease all use of the Software that this Agreement governs, destroy all copies then in your possession or control and take such other actions as Altova may reasonably request to ensure that no copies of the Software remain in your possession or control. The terms and conditions set forth in Sections 1(h), 1(i), 1(j), 1(k), 1(l), 2, 5, 7, 9, 10, 11, and 11 survive termination as applicable.

9. RESTRICTED RIGHTS NOTICE AND EXPORT RESTRICTIONS

The Software was developed entirely at private expense and is commercial computer software provided with **RESTRICTED RIGHTS**. Use, duplication or disclosure by the U.S. Government or a U.S. Government contractor or subcontractor is subject to the restrictions set forth in this Agreement and as provided in FAR 12.211 and 12.212 (48 C.F.R. §12.211 and 12.212) or DFARS 227. 7202 (48 C.F.R. §227-7202) as applicable. Consistent with the above as applicable, Commercial Computer Software and Commercial Computer Documentation licensed to U.S. government end users only as commercial items and only with those rights as are granted to all other end users under the terms and conditions set forth in this Agreement. Manufacturer is Altova GmbH, Rudolfsplatz 13a/9, A-1010 Vienna, Austria/EU. You may not use or otherwise export or re-export the Software or Documentation except as authorized by United States law and the laws of the jurisdiction in which the Software was obtained. In particular, but without limitation, the Software or Documentation may not be exported or re-exported (i) into (or to a national or resident of) any U.S. embargoed country or (ii) to anyone on the U.S. Treasury Department's list of Specially Designated Nationals or the U.S. Department of Commerce's Table of Denial Orders. By using the Software, you represent and warrant that you are not located in, under control of, or a national or resident of any such country or on any such list.

10. U.S. GOVERNMENT ENTITIES

Notwithstanding the foregoing, if you are an agency, instrumentality or department of the federal government of the United States, then this Agreement shall be governed in accordance with the laws of the United States of America, and in the absence of applicable federal law, the laws of the Commonwealth of Massachusetts will apply. Further, and notwithstanding anything to the contrary in this Agreement (including but not limited to Section 5 (Indemnification)), all claims, demands, complaints and disputes will be subject to the Contract Disputes Act (41 U.S.C. §§7101 *et seq.*), the Tucker Act (28 U.S.C. §1346(a) and §1491), or the Federal Tort Claims Act (28 U.S.C. §§1346(b), 2401-2402, 2671-2672, 2674-2680), FAR 1.601(a) and 43.102 (Contract Modifications); FAR 12.302(b), as applicable, or other applicable governing authority. For the avoidance of doubt, if you are an agency, instrumentality, or department of the federal, state or local government of the U.S. or a U.S. public and accredited educational institution, then your indemnification obligations are only applicable to the extent they would not cause you to violate any applicable law (e.g., the Anti-Deficiency Act), and you have any legally required authorization or authorizing statute.

11. THIRD PARTY SOFTWARE

The Software may contain third party software which requires notices and/or additional terms and conditions. Such required third party software notices and/or additional terms and conditions are located at our Website at http://www.altova.com/legal_3rdparty.html and are made a part of and incorporated by reference into this Agreement. By accepting this Agreement, you are also accepting the additional terms and conditions, if any, set forth therein.

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12. JURISDICTION, CHOICE OF LAW, AND VENUE

If you are located in the European Union and are using the Software in the European Union and not in the United States, then this Agreement will be governed by and construed in accordance with the laws of the Republic of Austria (excluding its conflict of laws principles and the U.N. Convention on Contracts for the International Sale of Goods) and you expressly agree that exclusive jurisdiction for any claim or dispute with Altova or relating in any way to your use of the Software resides in the Handelsgericht, Wien (Commercial Court, Vienna) and you further agree and expressly consent to the exercise of personal jurisdiction in the Handelsgericht, Wien (Commercial Court, Vienna) in connection with any such dispute or claim.

If you are located in the United States or are using the Software in the United States then this Agreement will be governed by and construed in accordance with the laws of the Commonwealth of Massachusetts, USA (excluding its conflict of laws principles and the U.N. Convention on Contracts for the International Sale of Goods) and you expressly agree that exclusive jurisdiction for any claim or dispute with Altova or relating in any way to your use of the Software resides in the federal or state courts of the Commonwealth of Massachusetts and you further agree and expressly consent to the exercise of personal jurisdiction in the federal or state courts of the Commonwealth of Massachusetts in connection with any such dispute or claim.

If you are located outside of the European Union or the United States and are not using the Software in the United States, then this Agreement will be governed by and construed in accordance with the laws of the Republic of Austria (excluding its conflict of laws principles and the U.N. Convention on Contracts for the International Sale of Goods) and you expressly agree that exclusive jurisdiction for any claim or dispute with Altova or relating in any way to your use of the Software resides in the Handelsgericht, Wien (Commercial Court, Vienna) and you further agree and expressly consent to the exercise of personal jurisdiction in the Handelsgericht Wien (Commercial Court, Vienna) in connection with any such dispute or claim. This Agreement will not be governed by the conflict of law rules of any jurisdiction or the United Nations Convention on Contracts for the International Sale of Goods, the application of which is expressly excluded.

13. TRANSLATIONS

Where Altova has provided you with a foreign translation of the English language version, you agree that the translation is provided for your convenience only and that the English language version will control. If there is any contradiction between the English language version and a translation, then the English language version shall take precedence.

14. GENERAL PROVISIONS

This Agreement contains the entire agreement and understanding of the parties with respect to the subject matter hereof, and supersedes all prior written and oral understandings of the parties with respect to the subject matter hereof. Any notice or other communication given under this Agreement shall be in writing and shall have been properly given by either of us to the other if sent by certified or registered mail, return receipt requested, or by overnight courier to the address shown on Altova's Web site for Altova and the address shown in Altova's records for you, or such other address as the parties may designate by notice given in the manner set forth above. This Agreement will bind and inure to the benefit of the parties and our respective heirs, personal and legal representatives, affiliates, successors and permitted assigns. The failure of either of us at any time to require performance of any provision hereof shall in no manner affect such party's right at a later time to enforce the same or any other term of this Agreement. This Agreement may be amended only by a document in writing signed by both of us. In the event of a breach or

threatened breach of this Agreement by either party, the other shall have all applicable equitable as well as legal remedies. Each party is duly authorized and empowered to enter into and perform this Agreement. If, for any reason, any provision of this Agreement is held invalid or otherwise unenforceable, such invalidity or unenforceability shall not affect the remainder of this Agreement, and this Agreement shall continue in full force and effect to the fullest extent allowed by law. The parties knowingly and expressly consent to the foregoing terms and conditions.

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